TECHNOLOGY DEPARTMENT

January 1948

TECHNOLOGY REVIEW

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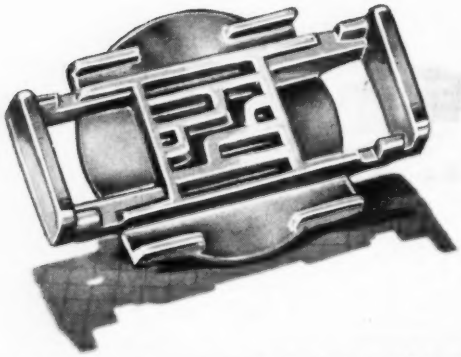
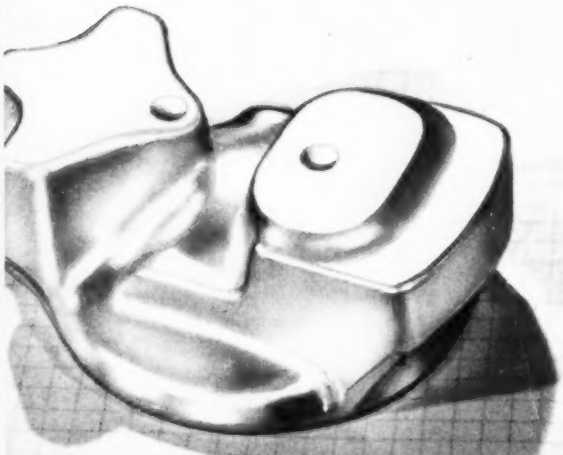
IMPROVE QUALITY.. LOWER COSTS..*USE* FORGINGS



UNLIMITED APPLICATIONS



THE HARVEY METAL CORPORATION

HAROLD E. HARVEY '03 • *Engineers & Manufacturers* • SHERRY O'BRIEN '17

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the slightest eye-injury COSTS MORE

than the goggles that can prevent it

Typical records indicate that even the slightest of eye-injuries costs (in lost time, idle machine time and medical attention), approximately $15.00. The Society for the Prevention of Blindness estimates that *ninety-eight per cent* of these injuries can be prevented by the use of safety goggles (averaging in cost $1.50 a pair) What piece of plant equipment costs so little and returns its cost so many times?

Let your nearest A-O Safety Representative show you the *complete* story.

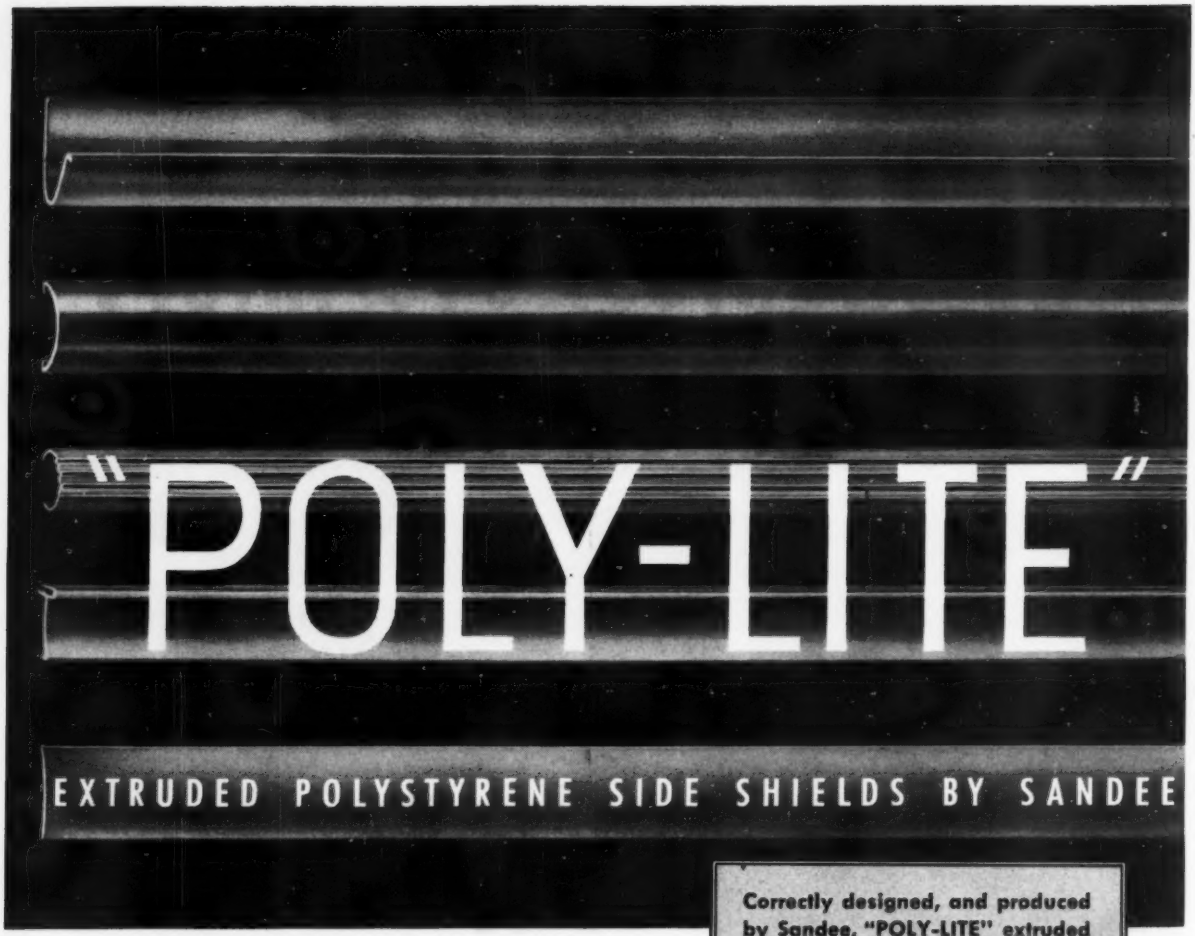
A-O Safety Goggles Safeguard the Eyes of Industry

American Optical COMPANY — *Safety Division*

SOUTHBRIDGE, MASSACHUSETTS

BRANCHES IN PRINCIPAL INDUSTRIAL CITIES

THE TECHNOLOGY REVIEW, January, 1948. Newsstand Edition. Vol. L, No. 3. Published monthly from November to July inclusive at 10 Ferry Street, Concord, N. H. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $3.50; Canadian and Foreign subscription $4.00. Entered as second-class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.



Correctly designed, and produced by Sandee, "POLY-LITE" extruded sections offer these outstanding advantages to Fluorescent Lighting Manufacturers.

1. **Extreme light weight**
2. **Controlled *uniform* light transmission**
3. **Very excellent rigidity**
4. **Very excellent dimensional stability (resistance to distortion)**
5. **Unsurpassed design possibilities**
6. **Ease of cleaning (maintenance)**

SANDEE extruded POLYSTYRENE sections are an outstanding contribution to the Fluorescent Lighting Industry. They far surpass any competitive materials in giving the maximum in modern lighting efficiency.

Sandee's practical knowledge of materials, designing for extrusion and production techniques is unsurpassed for sections suited to Fluorescent Fixtures. This *practical* knowledge is available to you on request in developing your specially styled fixtures.

"POLY-LITE" IS A GUARANTEE OF QUALITY

SALES REPRESENTATIVES IN 19 PRINCIPAL CITIES

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EXTRUDED PLASTICS AND SPECIAL TOOLS

347 NORTON EMPLOYEES RECEIVE SERVICE AWARDS at Annual Party

ON December 6 over 1300 Norton men and women were company guests in Worcester's Municipal Auditorium for the 26th annual presentation of Service Awards:

212 — 10 years service
47 — 15 years service
59 — 25 years service
29 — 35 years service

Approximately 10% of all Norton employees have been with the company 25 years or more.

These figures attest to the truth of the phrase so often heard in Worcester, "Norton's is a good place to work" . . . And in the quality of Norton products you get the benefit of this experienced personnel.

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Abrasives • Grinding Wheels • Grinding and Lapping Machines • Refractories • Porous Mediums • Non-slip Floors • Norbide Product

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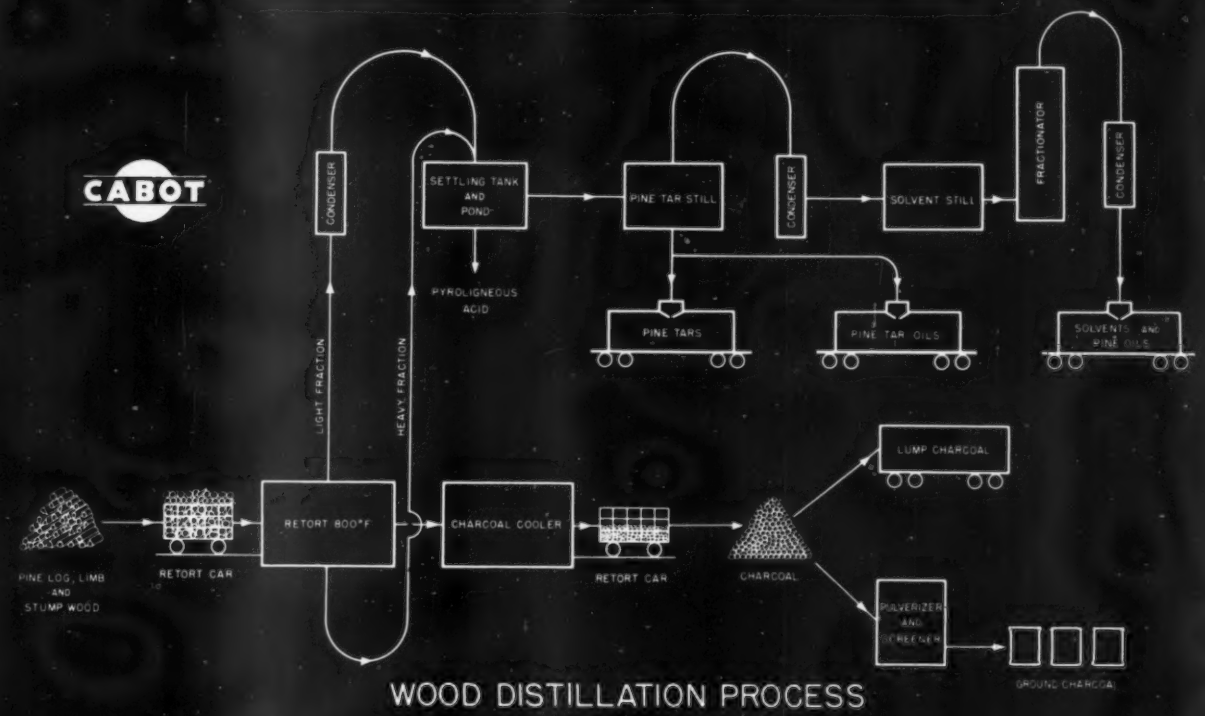
Retort Chemical Division
CABOT CARBON COMPANY



WOOD DISTILLATION PROCESS

Pine products supplied by Retort Chemical Division, Cabot Carbon Company, have many applications in industry. The rubber, paint, cordage, mining, metallurgical, insecticide, printing ink and paper industries are only a few. To these, and other industries, Retort's enlarged plant at Gainesville, Florida, is a primary source for destructively distilled pine tar, pine tar oils, pine oils, solvents, pyroligneous acid and charcoal.

New technical bulletin available.

GODFREY L. CABOT, INC.

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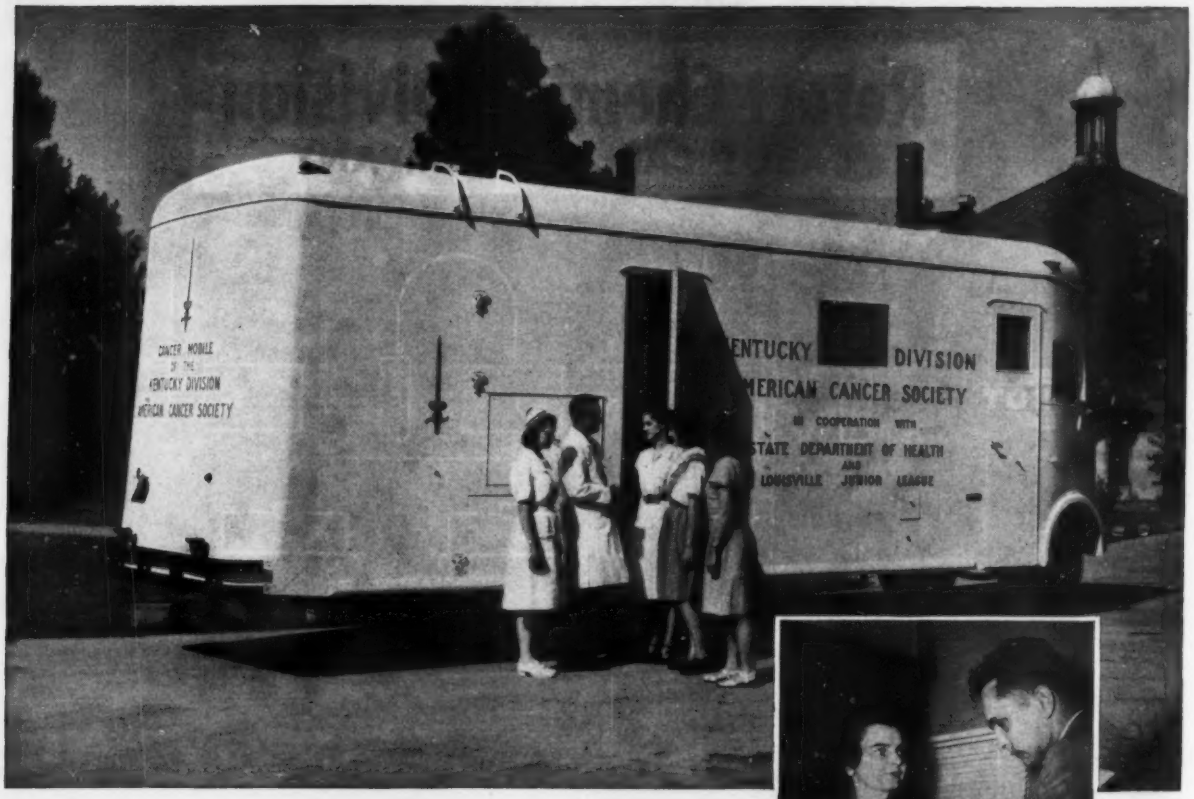

First 'CANCER MOBILE'

"To make the benefits of x-ray available to more and more people..." That has been the goal of General Electric x-ray specialists since 1913, when the company's energies were first directed into x-ray research by the work of Dr. William D. Coolidge.

Now, with the development of the Cancer Mobile by the combined efforts of the Kentucky division of the American Cancer Society and General Electric, x-ray facilities will be carried into the most remote areas, and to the humblest homes.

The farmer's wife with the lump in her breast, the village store clerk whose voice has dwindled to a hoarse whisper, no longer need live in fear for months wondering whether or not they have cancer. Rural doctors who lack x-ray facilities will use the bus for their private patients. But in addition, those unable to pay will receive free examination.

The Cancer Mobile goes into action along trails of service already marked out by more than fifty mobile tuberculosis-control x-ray buses equipped by General Electric.

You can put your confidence in

GENERAL ELECTRIC

COMMUNITY CENTER

The McCarthy Center, now under construction in Houston, Texas, will comprise the 18-story Shamrock Hotel; a garage to house 1,275 cars; a shopping center of several buildings; a theatre seating 1,750, complete with concert stage; a 50-meter swimming pool; and a 15-acre parking lot.

Stone & Webster Engineering Corporation are the project managers for the construction of this comprehensive community center.

WYATT C. HEDRICK, ARCHITECT

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

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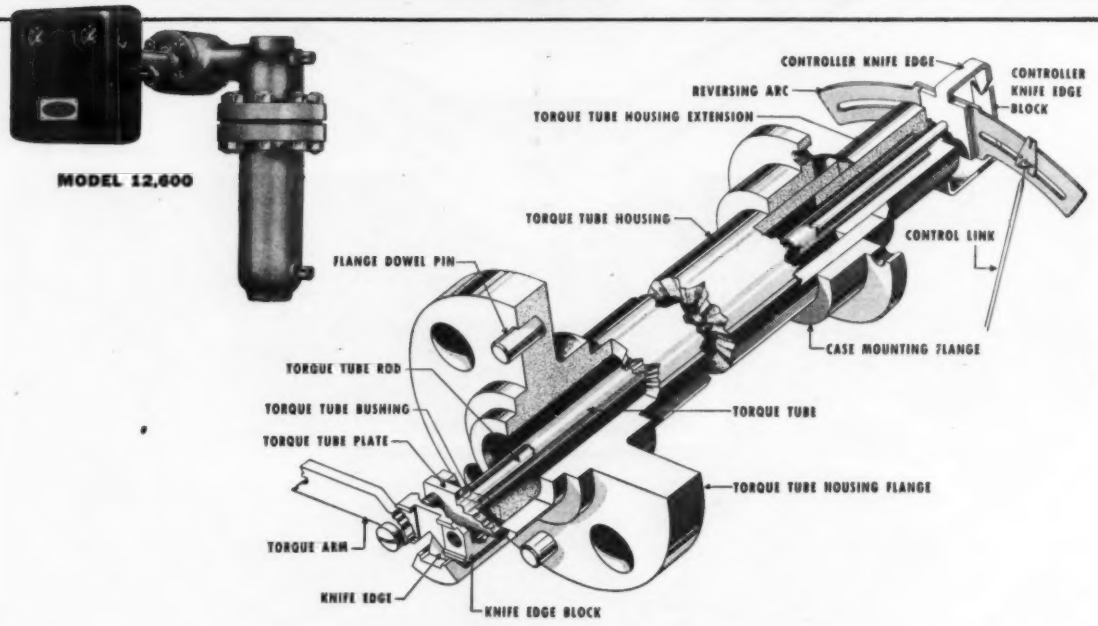

Actual field records prove that the torque tube . . . the heart of the Masoneilan 12000 series level controllers . . . gives years of service without failure.

The reason you are assured years of continuous uninterrupted service lies in the design and construction of the torque tube assembly. The entire unit is built of a single alloy, inconel.* This plus atomic-hydrogen arc welding gives homogeneity with highest mechanical strength and high resistance to corrosion and fatigue.

*Type 316 stainless steel, monel and phosphor bronze also available.

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Cleveland Chicago Atlanta St. Louis
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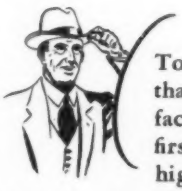
Industries Served by TAFT-PEIRCE:

6. The Hat Industry

If there's a HAT TRICK on your mind
. . . better take it to TAFT-PEIRCE!



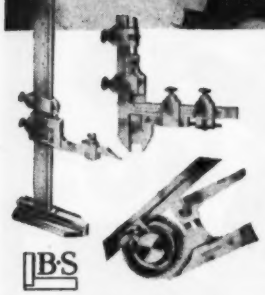
To Woonsocket has come more than one harried hatter with a manufacturing problem which looked, at first glance, as impossible as the next high-style hat you'll meet on the street.

Yet these "impossibilities," when tried on for size in the Taft-Peirce Contract Division, were converted with rabbit-speed into profitable practicalities. For instance, one particular engineering "topper" took the form of a machine like a treadless tank, which gobbles up loose fur at one end, applies twenty feet of unseen voodoo, and then produces an endless line of roughed-out hats all ready for processing. Fur doesn't fly. Felt quality doesn't vary. And you can paste that in *your* hat (which, more than likely, started life on this machine).

If you have an "impossible" which needs doing — or any other manufacturing problem — whether for hat, frozen food, vacuum cleaner, or what not—the Taft-Peirce Contract Division will tool and build the special production machines you need, in strictest confidence if you say so. And if the end-product is a mechanism or machine, Taft-Peirce will produce that, also, in medium lots or in quantity. For full details and terms, write to The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

For Engineering, Tooling, Contract Manufacturing

TAKE IT TO TAFT-PEIRCE



Brown & Sharpe has always put into fine machinists' tools the largest possible measure of good workmanship, fine materials, and sound design. For example, the machine-divided graduations on Brown & Sharpe Vernier Tools.

Brown & Sharpe machinists' tools give every purchaser a generous return on a sound investment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the distributor.

THE TABULAR VIEW

Perpetual Replacement. — Not long after 1900 the need for greater efficiency, for a more intense cultivation, and especially for conservation measures became clear. The basic concepts of conservation of this nation's land, water, and wild-life resources are discussed (page 149) by DR. IRA N. GABRIELSON who, in a convincing dissertation, demonstrates that these resources can provide perpetual gain and benefit when properly managed. Trained as a biologist, Dr. Gabrielson has been active since 1915 in studying and directing research on wild life and game management for the Bureau of Biological Survey, United States Department of the Interior. At present, Dr. Gabrielson is president of the Wildlife Management Institute. His article in this issue was one of two lectures given to students in the Department of Civil Engineering last spring.

Aerial Dimension. — The full social implications of technological advances are discerned in an evolutionary process, rather than springing full-grown with each manifestation of significant technical progress. Based on a background of more than four decades of flying with heavier-than-air machines, the social significance of aerial travel is discussed (page 154) by DR. PAUL MEADOWS, Associate Professor of Sociology at the University of Nebraska. As his primary interest, Dr. Meadows is concerned with the social impact of technological changes. His earlier articles on this general theme which The Review has published have been well received.

HEVI DUTY

Hevi Duty Electric Co.

Surges Transformers

With the acquisition of the Surges Electric Company of Milwaukee, Hevi Duty can now offer quality dry type air cooled transformers with or without tap changing switches as well as special transformers for special requirements. An accelerated program of modernization will present opportunities for increased production and good delivery schedules.

Write for Bulletin S-4611

HAROLD E. KOCH '22, *President*

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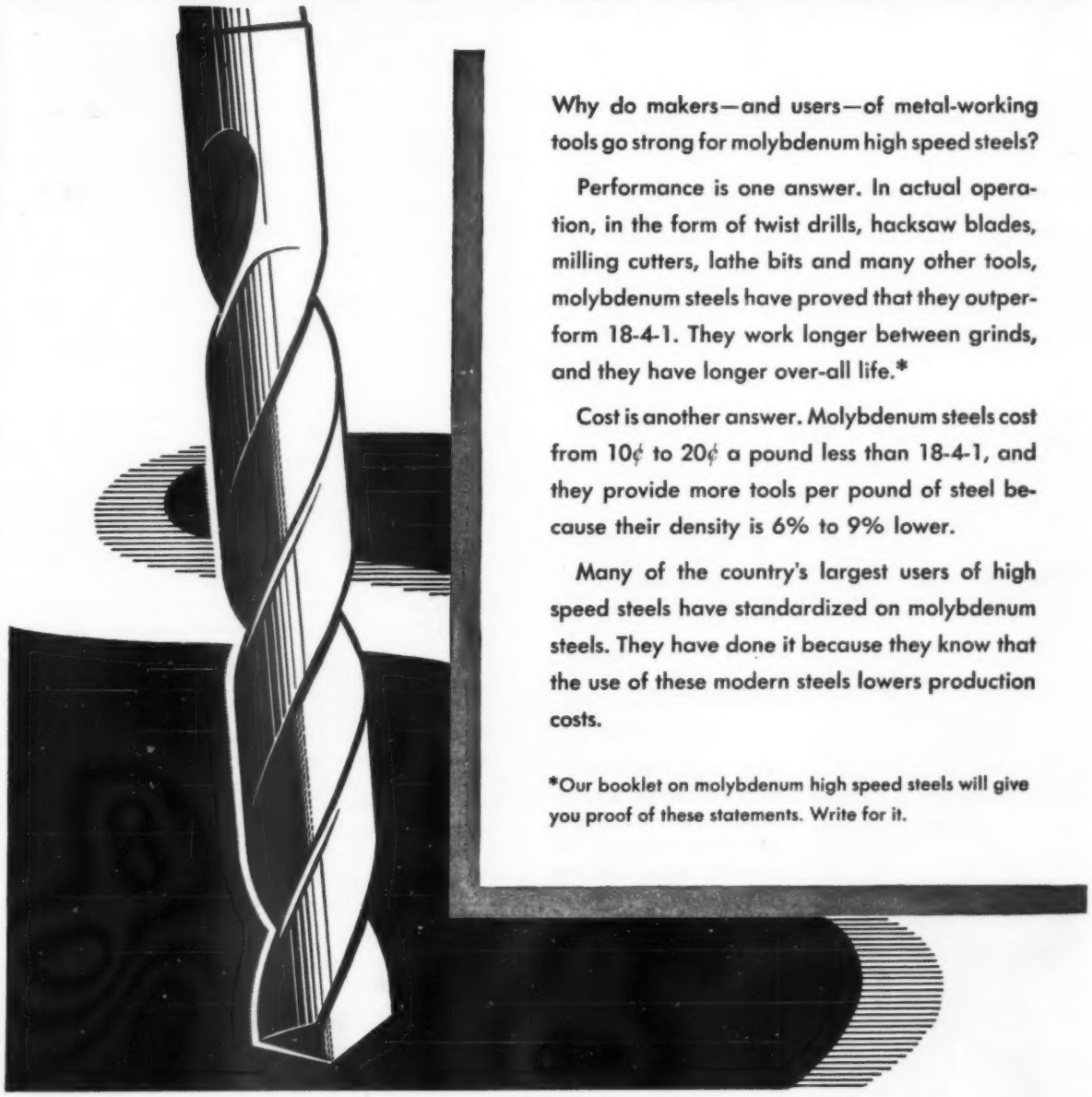
Over half a million Subminiature Tubes are carried in stock.

Sales engineering service is maintained in Newton, Chicago, Los Angeles and London.

WHY THE TREND IS TO Mo HIGH SPEED STEELS



Why do makers—and users—of metal-working tools go strong for molybdenum high speed steels?

Performance is one answer. In actual operation, in the form of twist drills, hacksaw blades, milling cutters, lathe bits and many other tools, molybdenum steels have proved that they outperform 18-4-1. They work longer between grinds, and they have longer over-all life.*

Cost is another answer. Molybdenum steels cost from 10¢ to 20¢ a pound less than 18-4-1, and they provide more tools per pound of steel because their density is 6% to 9% lower.

Many of the country's largest users of high speed steels have standardized on molybdenum steels. They have done it because they know that the use of these modern steels lowers production costs.

*Our booklet on molybdenum high speed steels will give you proof of these statements. Write for it.

MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

Climax Molybdenum Company

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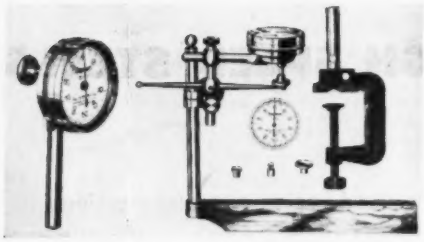
MOLY

A CINCH TO SET UP



UNIVERSAL DIAL TEST INDICATOR NO. 196

Simple, reliable, sensitive, easy to read, easy to set up and use — that's what makes STARRETT Dial Test Indicator No. 196 a favorite with toolmakers, machinists and inspectors. Many special attachments provide for universal application to all classes of work. Dial graduated .001", reading 0–100, range .200". For complete information see new Starrett Dial Indicator Catalog "L". *Write for a copy.*

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Gear Plans For '48

Year after year Diefendorf has served leading industries with gears cut to specification for special machinery—maintenance—repairs—replacements and on production contracts. Diefendorf engineers will work on any gear problem for the year ahead.

•

DIEFENDORF GEAR CORPORATION
Syracuse 1, New York

DIEFENDORF GEARS

MAIL RETURNS

David and Goliath

FROM ROBERT E. TOUZALIN, '39:

The blast furnace of the Ford Motor Company, pictured on page 97 of the December, 1947, issue of The Review, is certainly a Goliath when compared with the Cornwall furnace on the opposite page, but by contrast with the largest units in operation today it is a small furnace. Its rated production of 625 tons per day is dwarfed by comparison with that of today's largest furnaces.

During the past five years a number of blast furnaces, with rated capacities of between 1,400 and 1,500 tons of pig iron per day, have been put into operation.

One example of these modern furnaces is Armco's Bellefonte furnace located in Ashland, Ky. This representative modern unit, towering well over 200 feet in height, can produce about 1,300 tons of pig iron per day.
Cleveland, Ohio

In illustrating Professor Hayward's masterly discussion "How Long Will Our Metals Last?" in the December issue of The Review, the objective was merely to show a comparison of colonial and current practice, rather than to provide examples of the largest and smallest units which could be discovered. Nevertheless, The Review is indebted to Mr. Touzalin, not only for his acute comments and prompt reply, but also for his thoughtfulness in supplying a night photograph of the Armco furnace, as though in evidence that the matter is permanently and firmly clinched. — Ed.

Welcome Stranger

FROM FREDERIC W. LORD, '93:

Will you please send a subscription form to an intimate friend of mine whose name and address are attached?

He is not an M.I.T. graduate but says that The Technology Review is one of the finest papers published in the country and he would like to subscribe.
New York 20, N. Y.

Speed with Economy

Alex. Smith & Sons Carpet Co.

When you select a reliable builder, you can keep your mind on *your business* instead of on the building project . . . Important these days.

W. J. BARNEY CORPORATION
101 PARK AVENUE, NEW YORK
INDUSTRIAL CONSTRUCTION
Alfred T. Glassett, '20, Vice President

"—Many shall run to and fro, and knowledge will be increased" —DANIEL XII, 4.

Why transportation gets better all the time

OVER SIX HUNDRED MILES AN HOUR in the air, four hundred on land, one hundred on water—these are the speeds that are telescoping time and space today.

The world shrinks and shrinks . . . Distances that were once days, weeks, months away are now a matter of hours. What things behind the scenes have brought these whirlwind developments in transportation?

There's chromium, for one. Basis of stainless steel, it toughens planes, cars, trains . . . insures added safety . . . yet makes them lighter throughout.

There are special carbon brushes necessary to the operation of some thirty motors and generators used in the control apparatus of modern transport planes. These brushes must be built to stand up under the pressures of high altitude flying.

Colorful plastics, too, lend their lightness, give their strength, safety and serviceability.

And gasoline now gives more power—has more get-up-and-go—takes you farther at less cost . . . thanks to new vitalizing chemicals.

Producing these better materials and many others—for the use of science and industry and the benefit of mankind—is the work of the people of UNION CARBIDE.

FREE: *You are invited to send for the illustrated booklet, "Products and Processes," which describes the ways in which industry uses UCC's Alloys, Carbons, Chemicals, Gases and Plastics.*

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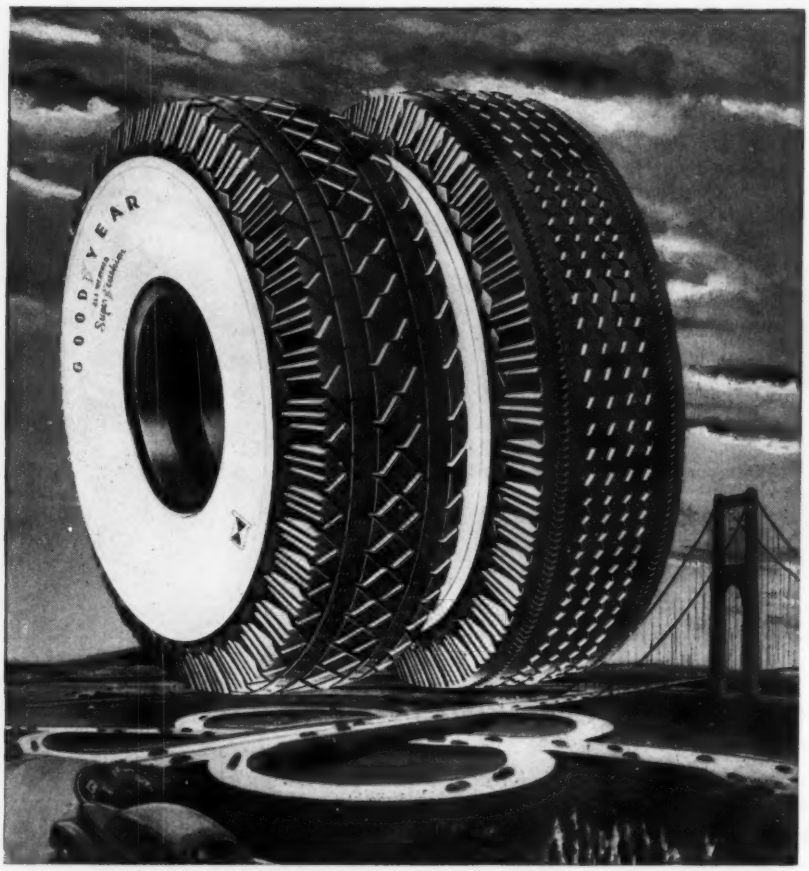
PRESTONE AND TREK ANTI-FREEZES • ELECTROMET ALLOYS AND METALS • HAYNES STELLITE ALLOYS • SYNTHETIC ORGANIC CHEMICALS

Why car makers adopted this new kind of tire

SUPER-CUSHION RUNS ON ONLY 24 POUNDS OF AIR; GIVES INCREDIBLY SOFTER RIDE, BETTER CAR HANDLING, MORE MILEAGE AND CAR ECONOMY!

Car makers astonished—After testing the Super-Cushion, car makers said: "This tire makes a *big* improvement in the performance of modern motor cars. "It's the biggest tire advance in 15 years!" They quickly adopted it for their new cars. Here's why you'll want this remarkable new tire for your car . . .



1. Softer ride—safer, easier car handling! The Super-Cushion is a bigger, *softer* tire. It runs on only 24 pounds of air instead of 28 to 32. So you get a noticeably smoother, *softer* ride.

And you get a remarkable new ease and security in car handling. Your car *hugs* the road, seems to float through traffic, to *flow* around curves.

2. Actually lengthens the life of your car! Till Goodyear produced the Super-Cushion, lateral or crosswise shock (right) had never been licked in motor cars. Pillowy Super-Cushions *soak up* crosswise jolts, *soak up* vibration.

Result: *less driving fatigue, less wear and tear on your car, fewer rattles, fewer repair bills!*

3. More mileage—extra blowout resistance! Super-Cushions run cooler (heat is a tire's worst enemy). Softer, they "roll with the punch," are harder to cut, bruise or blow out. So Super-Cushions consistently average more mileage than the best standard tires.

Two other big advantages: 1. Super-Cushions make a small car ride like a big one. 2. They dress up the appearance of your car!

See your Goodyear dealer *now*. If he doesn't have your size at the moment, he'll have it soon.

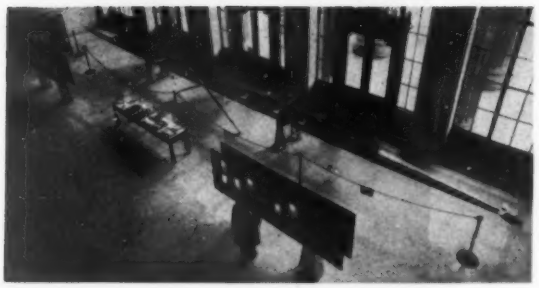
For the smoothest, safest ride you've ever had, more mileage and lower car economy, switch to Super-Cushions, whether your car is old or new. They'll make a big difference on the road.

MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND

The new *Super-Cushion* by GOODYEAR

Super-Cushion T.M.—The Goodyear Tire & Rubber Company

VOL. 50 No. 3



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Contents for January, 1948

WHEN WINTER COMES • *Photograph by James H. Thomas* . . . . . THE COVER

CURTAINS OF LIGHT • *Photographs by John J. Rowlands* . . . . . FRONTISPIECE 144

CONCEPTS IN CONSERVATION OF LAND, WATER, AND WILD LIFE . . *By* IRA N. GABRIELSON 149
When properly managed, the natural resources of this country can produce things of value indefinitely

AERIAL DIMENSION . . . . . *By* PAUL MEADOWS 151
Aviation is viewed as an agency which boldly alters many aspects of our contemporary civilization

FACULTY IN RELAXATION 158
Recent exhibit of the Faculty Club demonstrates manifold interests on the part of the Institute's teaching staff

STUDENTS AT PLAY 159
In a week end of relaxation and competitive sports, students at M.I.T. engage in intercollegiate athletics

THE TABULAR VIEW • *Contributors and Contributions* 138

MAIL RETURNS • *Letters from Review Readers* 140

THE TREND OF AFFAIRS • *News of Science and Engineering* 145

THE INSTITUTE GAZETTE • *Relating to the Massachusetts Institute of Technology* 160

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Curtains of Light

Northern lights — beautiful and fascinating — have long interested inhabitants of northern climates. The two examples of aurora borealis were photographed last August 14, where Canada's Moose River joins James Bay. Looking north over bleak and desolate marshes from the Moose Factory Post of the Hudson's Bay Company, these streamers of pale green, rose, and yellow were captured during 10-second exposures by John J. Rowlands, Director of News Service at M.I.T.

THE
TECHNOLOGY
REVIEW

Vol. 50, No. 3 January, 1948

The Trend of Affairs

Fore and Aft

AT the beginning of the first month marked on our calendars it is natural for thoughts to be turned to the fore. New hope and vigor for better things to come are traditionally reflected in anticipation of the future. As the past proclaims the future, it is befitting also to glance aft, to linger over the accomplishments of the past and to meditate particularly upon those events which have wrought significant changes in our lives. It becomes inspiring, also, to record events transpiring in years ending with the number eight, or those years for which the new year, 1948, will mark anniversaries in quarter-century multiples.

Just 175 years ago, in 1773, Sir Henry Cavendish in England took the first step in establishing electrical science on a quantitative basis, in experiments which showed the force of attraction between two isolated electric charges, concentrated at points, to be inversely proportional to the distance between them. Fifty-five years later, in 1828, the American, Joseph Henry, built the first electromagnet, being forced in the process to insulate his own wire. Another step advancing electrical communication was made in 1858 when the first message was transmitted across the Atlantic Ocean by telegraph cable. In New Haven, Conn., the first telephone switchboard was opened for commercial service on January 28, 1878. A decade later the German physicist, Heinrich Hertz, experimentally produced and detected electromagnetic "waves of electric force" thereby confirming the mathematical predictions of Maxwell some two decades earlier. In 1898 the Italian, Guglielmo Marconi, working in England, succeeded in maintaining radio communication over a distance of 30 miles thereby giving utilitarian value to Hertz's laboratory investigations. Coming to more recent times, just 25 years ago, on January 4, the first radio chain broadcast between New York and Boston was put into operation, and on January 14, 1923, one-way transoceanic telephony from New York to London was demonstrated. Both were accomplishments of engineers of the Bell Telephone System.

The year 1948 throws the spotlight on several anniversaries in printing and photographic developments. In 1798 Count Rumford contributed a paper to the *Philosophical Transactions* on "An Inquiry Concerning the Chemical Properties that Have Been Attributed to Light" in which was summarized the knowledge of photochemistry of 250 years ago. The carbon printing process was invented by Mungo Ponton in France in 1838, and in England, three-quarters of a century ago, William Willis invented the photographic platinotype process. It is reported that the prototype of motion pictures dates to experiments of Eadweard J. Muybridge in 1878 in which the motions of a racing horse were photographed. The greatest single factor in the public's participation in photography was the invention of the dry roll film and the first camera to operate satisfactorily when held in the hands. Both of these developments, made in 1888, owed their existence to George Eastman, a revered name to M.I.T. Alumni since it became known that the anonymous "Mr. Smith," whose financial benefactions helped to build a larger and more influential Technology, was synonymous with the great inventor.

A type casting and setting machine was invented by Church in the United States in 1828, the same year in which Isaac Adams gave the world the power printing press. In another half century, printing and photography were destined to be combined in the half-tone engraving process. Although dispute surrounds early work in this field, credit is usually given to F. E. Ives for having conceived and reduced to practice the variable dot structure of producing images in 1878.

In the field of transportation, the coming year marks the 125th anniversary of the freight car invented by Gridley Bryant in 1823. On March 28, 1858, E. A. Gardner received a patent for his cable car but 15 years were to pass before the first cable street car in the world was put into service in San Francisco on August 1, 1873. It

Photo by Harold J. Loveless from Buick Staff

was the invention of Andrew S. Hallide. In the same year, E. H. Janney contributed to speeding railroad operations by the automatic car coupler patented five years earlier. Eighty years ago, in 1868, W. W. Austin of Winthrop, Mass., devised the first motorcycle — a steam-driven affair with a boiler amidships. An early horseless carriage was made by Serpollet in France in 1888 and 10 years later the first automobile truck was designed and built by Louis S. Clarke in Pittsburgh. Ethyl gasoline was first marketed in Dayton, Ohio, in 1923. This was the same year in which closed automobiles were sold for less than $1,000 each, but today the trend of a quarter century ago is reversed. A mere 10 years ago, automobiles with improved windshield vision, catwalk grilles, independently sprung wheels, and airfoam seat cushions were the center of attraction in automotive engineering; today, automobiles are definitely "in short supply."

In the field of pure science, the year 1948 marks the 150th anniversary of Cavendish's measurement of the earth's mean density, for it was in 1798 that the somewhat eccentric aristocrat made the first proof and measurement of the force of gravitational attraction between two terrestrial masses small enough to be contained in an ordinary room. A century and a quarter back, in 1823, Michael Faraday liquefied chlorine, carbonic acid, and other gases. Three-quarters of a century ago Johannes D. van der Waals established his equation for the relation between pressure and volume of carbon dioxide at different temperatures, thus summarizing all questions of the liquefication of gases. The Lick Observatory at the University of California installed and exhibited the first seismograph in 1888.

In agriculture and food technology it is possible to record that the first patent on oleomargarine was obtained 75 years ago by Hippolyte Mège of France on December 30, 1873, the same year in which an American woman, Amanda Jones, became responsible for a process of preserving fruit. Only 20 years ago, in 1928, R. Kemp is credited with being the father of whole-process tomato juice. Possibly of great public-health value, but hardly to be classed as a contribution to the society of gourmets, is the first practical large-scale use of chlorine for water purification in Jersey City in 1908. Now, more than half the country's population is supplied with chlorinated water.

In educational circles, the year 1868 is significant for at least two important events. On April 29 William Barton Rogers requested and was quickly granted authority by the Commonwealth of Massachusetts to award degrees to students upon satisfactory completion of a course of study at the Massachusetts Institute of Technology. Fourteen students constituted the Institute's first graduating class. Also in 1868 the first English-speaking kindergarten was opened in Boston by Miss Elizabeth Peabody.

Certainly one of the most eventful dates of a century ago is that of February 9 when gold nuggets were found near the mill of John A. Sutter at Coloma, Calif. This discovery touched off the trek of forty-niners and greatly accelerated settlement of the West. Also in this year the Chicago and Northwestern was to be the first railroad to run its trains west, out of Chicago. Looking toward national defense a century ago, as indeed we may well do today, it is fitting to recall that the *U.S.S. Saranac*, a 1,238-ton vessel built in 1848, was the first Navy warship propelled by steam. The sum of $10,000 was appropriated on August 14, 1848, for establishing national life-saving stations, and eight buildings were erected and appliances supplied for this modest amount. A century ago Boston established the first shirt factory in this country, and in Philadelphia the American Association for the Advancement of Science was organized on September 20. Perhaps the appearance of the first baby carriages in New York, but certainly the display of a new style of women's apparel (known as bloomers) in 1848, foreshadowed the emanicipation movement of women in this country. With an eye to political events to take place next year, it may be recalled that the first national committee of party political organizations will be entitled to celebrate its centennial on May 28. The first building in the United States constructed wholly of cast iron was a five-story factory built by James Bogardus in New York City.

Time became an important factor with the rise of industrialism and in 1858 Ira G. Blake improved timekeeping apparatus with his chronometer. During the same year, the Walls patent arctic gaiter, a waterproof overshoe made of cloth and rubber, became known. The first dining car was built by the Chicago and Alton Railroad Company and was placed in service in 1868. The first copper refinery to operate by the use of gaseous fuel was constructed in 1878 by William Durfee. The burgeoning electrical industry was assuming importance in the daily lives of persons in this country as indicated by the invention of a practical system for trolley cars in 1888 by Frank Sprague. In the same year, Oliver Shallenberger found a way to put the electric power companies on a paying basis with his electricity meter which recorded the total amount of electrical power consumed.

Half a century ago, when this country was at war with Spain, the first electric flashlight is reputed to have been marketed by the American Electric and Novelty Company of New York. Paper manufacture by the sulphite process was first introduced on a commercial scale in the same year. The first mineral segregation by flotation, the process that causes particles of the same species to cling together, was demonstrated by P. T. Elmore in the same year. To complete the record it may be noted, for better or for worse, that 25 years ago a tint of blushing was first injected into the Great White Way when there was installed on the marquee of New York's Cosmopolitan Theater the first neon sign.

Electronics Research

DURING November research workers from all parts of the country met in Chicago for the third annual National Electronics Conference at which were discussed matters of importance in the electronics field. Originally limited to applications in communication in which electron tubes were first used, the field of electronics has broadened out, especially during the past decade, to include electronic instrumentation, industrial applications in measurement and control, electronic heating, mathematical computing devices, and military applications. Electronics also makes many important contributions to the comparatively new field of nucleonics as well, in which the interior structure of the atom is studied.

Papers were presented on various aspects of communications by Lawrence B. Arguimbau, Raymond A. Glaser, John Granlund, 10–44, Stanford Goldman, and Roberto M. Fano, '41, all of the M.I.T. staff.

As might be expected in a gathering of technically trained personnel, the major emphasis was on the scientific and engineering aspects of recent progress in the electronics field. Nevertheless there were a number of papers dealing with administrative and general topics. Indeed, in the opening address by Dr. George D. Stoddard, President of the University of Illinois, concern was expressed at the military applications which are being made of scientific achievements, and a call was sounded not for abandoning science in a moratorium as has several times been suggested, but in using science more effectively for man's good. In somewhat similar vein, Dr. L. V. Berkner of the Joint Research and Development Board discussed the need for better co-ordination in handling research problems of large magnitude and scope. The wartime development of radar cut across commercial lines, permitting the pooling of resources to carry out a project of national scope. The peacetime problems of aerial navigation and of freight dispatching could likewise be well handled by a similar co-operation of technical personnel, and indeed it seems unlikely that they can be nearly as well solved without large-scale co-operation.

Many of the technical papers indicated a healthy renewal of interests which were put aside when Pearl Harbor was attacked. In particular, there was added emphasis on improvements in the electrical reproduction of speech and music and on the reduction of needle scratch in phonograph reproductions.

Although it is not commonly recognized by persons remote from New York and Chicago, television is now an accomplished fact. Having been given the green light by the Federal Communications Commission, television is now developing rapidly. Windows of business establishments in the areas served carry invitations to the public to enter and view the program in progress. Several manufacturers have assembly lines in full production of television receivers, and a backlog of orders that more than covers their output for some time to come is reported from most of these manufacturers. Many other large cities beside New York and Chicago are expected to have stations in operation soon. It was, therefore, somewhat surprising to find only four of a total of 60 papers devoted to this new and growing field.

The economic limitation remains a large factor in determining the type of program now made available. Ready-made programs, such as prize fights, games, exhibitions and demonstrations are utilized as program material to a large extent, along with audience-participation programs involving sidewalk passers-by. In many cases the high price of television equipment (to which is usually added an installation charge of about $50) is a deterrent to sale of sets in the home, particularly in the absence of a continuous program of such quality as would be competitive with motion pictures.

Considerable progress was shown in the field of wire recording. Units including a complete radio receiver and recorder so that broadcast material could be recorded and monitored were demonstrated. The recorders were ingeniously constructed with a number of safety features to take care of accidental wire breakage. Playing time for a single reel of wire was usually 30 minutes, although one-hour reels were also available. Playback or rewind time was about 10 per cent of the playing time. Devices providing a continuous indication of running time, accurate to within a few seconds, were provided on many models. At normal operating speeds reproduction of music was as good as would be expected from any high-quality radio receiver.

Another interesting application of the magnetic recording technique was a voice-recording device employing flexible paper discs coated with iron powder, and providing means for recording a three-minute dictation. The paper disc can be folded and sent through ordinary mail channels for transcription at a distant point by means of a similar device, since one unit serves to record and transcribe. Provision is made to erase any part of the dictation at will.

Hearing aids as a means for employing electronics to aid one of the senses have been known for more than a decade, but a paper describing ultrasonic guidance devices for the blind opened the way for electronics to aid another sense. One guidance device which was demonstrated is essentially a form of echo-ranging equipment using a supersonic beam modulated with a signal in the range of audibility. The beam is projected from a portable guidance device which also receives and detects echoes reflected from solid objects. The blind operator receives information about his surroundings from the pitch or flutter of the detected sound. The equipment demonstrated worked well although it is still in the developmental stage.

The absorption of electromagnetic waves by gases oc-

Photo by Vachon from Standard Oil Co. (N. J.)

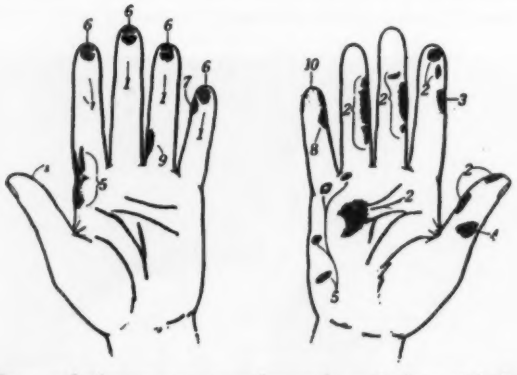
curs at frequencies which correspond to the rotational frequencies of the molecule. Since the absorption line frequencies can be measured to one part in a million, this method provides a precise means for determining molecular moments of inertia. In this way a new use for electronics in studying the atom and nucleus was reported in a survey paper on microwave spectroscopy.

One of the most interesting papers to be delivered was by Karl Lark-Horivitz of Purdue University on semiconductors. Since the earliest days of radio communication, partially conducting crystal detectors have been used, but the reason for their strange properties has not been well understood. The application of the quantum principle to the study of substances which are neither good conductors nor good insulators has made it possible to predict the performance of previously untried substances and to explain the large influence of impurities. Because of the peculiar properties of semiconductors, the study gives promise of yielding important new electric circuit components.

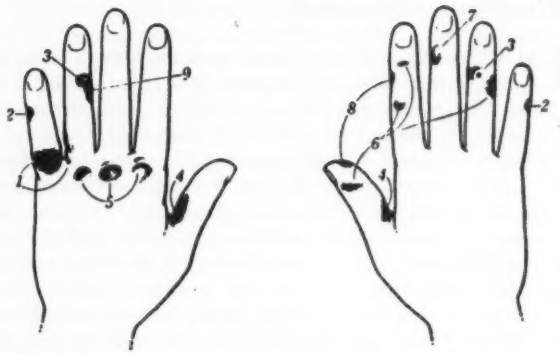
Marked Men

THE laborer's horny hand is not the only occupational stigma; many trades and even certain arts and professions bear characteristic physical marks. Horny handedness alone takes a number of unique forms. The stonecutter has a ring of callus on the back of the little finger where the chisel is steadied while it is grasped by the remaining fingers. Landscape gardeners have thick calluses on the knuckles of the left middle and ring fingers, as a result of the customary attitude of these artisans — leaning on the fisted left hand while working with the right. Musicians often bear characteristic hand calluses, located according to the instrument played. Common hand stigmata are shown in the accompanying illustrations.

Occupational marks on the hands are not confined to calluses. Right-handed bricklayers exhibit left finger tips worn smooth and shiny as a result of lifting and placing bricks with his hand. Dentists bear hand calluses similar to those of writers and artists, because the dentist's drill is customarily grasped in the same manner as a pencil. But dentists also frequently have unique hand stigmata, scars from repeated burns on the thumb and forefinger of the working hand produced when softening gutta-percha temporary fillings by holding them in the fingers near a flame. A frequently seen professional hand stigma is the nitric acid stain upon the fingers as worn proudly by all M.I.T. freshmen, indifferently by students of Course V (Chemistry) in later undergraduate and in graduate years, and with annoyance by practicing chemists as long as they work in the laboratory. Finally, hand stigmata may result from "foreign body reaction" to extraneous material that penetrates the skin; typical of this class of marks are milkers' nodules, deep red, warty excrescences on the hands resulting from entrance of cow's hair into the skin.



Calluses and stigmata occur more frequently on the front of the hand than on the back. Shown here are those of: 1, mason or bricklayer; 2, jeweler or engraver; 3, barber; 4, cobbler or shoemaker; 5, golf player; 6, stringed instrument player; 7, French horn player; 8, trumpet or tuba player; and 9, trombone player. The diagrams shown here are reproduced through the courtesy of The Journal of the American Medical Association.



Ensemble of the most common calluses, cicatrices, and stigmata on the hands of: 1, the stonecutter; 2, the burler; 3, the polisher of spectacle frames; 4, the janitor or sweeper; 5, landscape gardener; 6, seamstress; 7, writer, dentist or designer; 8, the barber; and 9, drum player.

We have seen that occupational marks on the hands are not limited to calluses: It is equally true that calluses and other occupational marks are not confined to the hands. Painters and other mechanics using ladders bear calluses near the middle of both shins, resulting from pressure of the rung of the ladder above the one on which the workman stands. Violinists and viola players often exhibit a characteristic dermatitis at the side of the neck where the instrument is held. The sedentary worker, in addition to the hand marks of his particular occupation, may have pigmented areas below each buttock resulting from continued pressure on the chair or stool.

Sports, even if pursued only avocationally, may result in characteristic marks. The right-handed golfer usually has heavy calluses on the left hand. The discus thrower and the bowler have hand calluses in characteristic locations, as also do the racket wielders, the players of squash, tennis, and badminton. Professional sportsmen show characteristic stigmata in exaggerated degree; witness the cauliflower ear of the boxer (most often the left ear), and the permanently contracted little fingers of baseball players that are produced by injury in the act of catching.

Occupational stigmata have important practical value in aiding identification of comatose or amnesic persons, or of corpses. They also are useful in criminology, particularly if fingerprints are unavailable because of destruction of the finger tips mechanically or by disease.

The stigmata of various trades become less marked as advances in industrial hygiene demand use of gloves and other protective clothing. Conversely, the marks of mechanics or laborers sometimes appear among a certain group of sedentary wage earners; the enthusiastic commuters who delight in doing (*Continued on page 174*)

Concepts in Conservation of Land, Water, and Wild Life

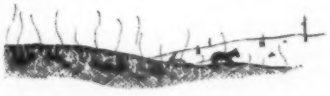
Under Proper Management, Natural Resources Can Produce Things of Value Indefinitely

By Ira N. Gabrielson

CONSERVATION is the wise use of our natural resources. Conservation is not a process of locking up those resources and keeping them for future use as is sometimes charged, but a concept of using wisely, and with care, those resources with which this land was originally endowed. These resources can be divided into two broad groups: the mineral or nonrenewable resources, which can be conserved only by utilizing them wisely and without waste, and the organic or renewable resources which, if properly managed, can continue to produce indefinitely things of value for the human race.

It is with this latter group that conservationists are now chiefly concerned. In the past there have been many conservation programs. There have been broad groups promoting the conservation of forests, wild life, soils, and most recently, waters. There are many smaller groups interested in single phases of wild-life conservation. Each of them has been more or less successful in proportion to the popular appeal and of the subject and the strength of the forces behind it. There are still many groups which are primarily interested in individual problems, but there is a growing public opinion that understands that the conservation of all renewable resources is inextricably intertwined and that it is difficult, if not impossible, to pick out any one element and carry on a conservation program for that alone without affecting, for good or evil, some other important elements.

Americans are proud of the fact that their energy and initiative have developed a great country in record time. There is no similar instance in history of a virgin land being developed into a great agricultural and industrial nation in so short a period of time. While there is much in this record of which the nation may well be proud, our achievements have been accompanied by an appallingly wasteful and destructive utilization of basic resources.

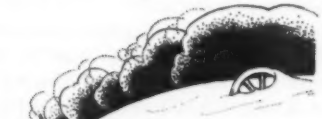


Virgin forests were cut, piled, and burned in order to make way for the plow; for years timber was, and is still, too often cut with appalling wastefulness of the present crop and a complete lack of concern for future forest growth. Land that never should have been farmed was broken; vast drainage schemes were promoted at public expense even when such schemes could have nothing but ill effects on the local and national economy.

Into this appalling wastefulness the three elements of ignorance, stupidity, and greed have entered conspicuously. It can be said charitably that in the earlier days much of the waste was due to ignorance. With present-day knowledge of the past waste of the national resources, we can attribute a continuation of many of these practices only to stupidity or greed; it is hard to say which is the most dominant. In spite of the knowledge that is available for the asking, it is still possible for an unscrupulous promoter to enlist business men, the chamber of commerce, or other local groups in a dubious drainage or development scheme which lacks many or all of the elements that might make it successful. Despite the record of past mistakes, this nation is still dissipating and unnecessarily destroying the basic resources on which its future depends.

Someone once said that the future of the human race was entirely dependent on the top 14 inches of soil. Like many epigrams this one contains much truth. All food, most of the clothing, and many other products that fill everyday human needs are products of the soil and water. So far as the future can be discerned, they will always be so produced. The development of the great plastics industry has not changed this picture. While plastics can be substituted for many uses to which metals are now devoted, they cannot replace food and other essentials. In fact, plastics are made largely from products of the soil. Those that have been developed from petroleum products or by-products were living plants and animals at one time and those that are produced from cellulose are direct products of the soil.

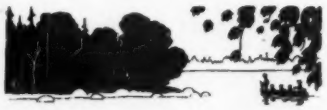
The rise and fall of many nations have been linked directly to abuse and destruction of that nation's soil. Many rose to greatness on virgin agricultural areas and declined with the destruction of the soil. The same historical sequence is inevitable in this country unless we learn to use more wisely the soils and waters of the United States. Scientists realize this keenly and have been trying for years to impress upon the general public the need for conservation. However, it took the spectacular dust



storms of the 1930's, resulting from wind erosion of the arid, drought-stricken plains country, to focus attention, even momentarily, upon some of the basic problems of maintaining our natural resources. Like all farm crops and animals, wild life, too, is directly dependent upon

the soil. In fact, all animal life, including man, is dependent upon plants which are the only living things capable of taking minerals, air, and water, and combining them into the complex substances that are required for human and animal nutrition. When man eats meat, he feeds upon the products of plant development and growth for, as a food, meat is only once removed from plants. Whether fish, fowl, or beast is eaten, man depends ultimately upon vegetation and this fact is one of the primary bases of the conservation concept.

The productive soils with which this country was originally endowed were built by a very complex process that required vast stretches of geologic time. Only by going through an exceedingly time-consuming evolution did soils become fertile and productive. Usually, the first step in the formation of soils is the breaking down and weathering of rock, as the result of wind, water, and temperature acting upon the rocks. Without forming immediately productive soils these rock particles contain mineral elements that provide basic fertility. These broken-down particles of rock may be moved, mixed, shuffled, deposited in layers, torn up and resorted by the action of erosive agents until they become capable of sustaining some type of plant life. A few plants are even capable of growing on the faces of solid rocks and the growth of their roots contributes to the actual breaking down of the rock. More and different plants can grow on newly broken-down rocks. As these plants grow and decay, the humus, which they create and return to the soil, enables other and higher types of plants to develop on the same area. Eventually a fertile topsoil is formed by the incorporation, with the mineral particles, of the decaying remnants of many generations of plants and animals. It is by this process that productive soils are built.



When the white man arrived in North America, he found a continent in which these processes had been going on for geological ages. As a result highly productive soils, naturally some better than others, were found. This natural process permits the return of all materials to the soil and as long as it continues, soils build toward a more productive condition. When the soil formation process is interrupted, as it is when man develops an agricultural program and begins to take away and market great quantities of the products of the soil, it is inevitable that soil building ceases and soil exploitation is started. Man recognizes this fact every time he fertilizes a piece of land, plows under a green crop, or spreads animal and plant wastes upon the soil.

Soils that are devoted to agricultural crops become more subjected to erosive agents and in the past the result has been that an accelerated erosion of the soils started immediately. Erosion has hastened the reduction of soil fertility far beyond any loss that came from the removal of the elements of fertility from the soil. Fluctuating streams, stream beds choking with silt at an extremely rapid rate, and other disastrous consequences follow destructive erosion processes. Soil destruction has been going on in America since the first settlers landed and is still affecting a major part of the land. Net results are easy to see. At the present time, something in excess of 100,000,000 acres of formerly good crop land is now completely unproductive. Some of it will not return to productive capacity for many thousands of years and then only as a result of the slow natural soil building process. Some of it can be brought back more rapidly by careful handling. Another 100,000,000 acres are seriously damaged and nearly all of the present land used for agriculture has deteriorated appreciably because of our crude methods of exploitation. In excess of 100,000,000 acres of swamp, marsh, and lake lands have been drained by one device or another. In some cases drainage has produced good agricultural land and in others it has not. In either case, but little thought has been given to a comparison of the value of land in its original condition and its value for agriculture, wild life, and the preservation of natural resources after drainage.

When the white man came to America, he found a land that was adequately clothed in vegetation, nature's major instrument for retarding erosion. Both the character and density of the vegetation varied with the fertility and character of the land, the amount of rainfall, and the climate. The eastern half of this country was largely an unbroken forested area. In mid-continent the grasslands and prairies were completely clothed with a turf and in the more arid areas of the country desert-inhabiting plants with vast root systems performed the function of soil protection.

To a large extent this vegetative cover has been disrupted, some of it necessarily and some of it needlessly so. Under conditions of natural growth the vegetative cover performed other functions in addition to its value in inhibiting erosion. It forced water into the soil and held it there stored for the future use of the plants: It maintained ground water tables and gradually fed the surplus water into the streams. The natural cover of vegetation held to a minimum variation in stream flow and the stored waters fed permanent streams and maintained ground water levels with small variation even during long periods of drought. In other words, nature's method for protecting the land, building its fertility and productiveness, and storing water is the natural mechanism by which the soils and vegetative resources can be maintained to the greatest benefit to the human race. A wise national policy would disrupt this mechanism as little as possible.

Conservationists realize that a return to the natural conditions of centuries ago is neither possible nor desirable. The present population of the country could not be maintained on the low agricultural productivity that existed prior to the voyage of Columbus. Conservationists do believe that the greatest possible use should be made of this natural mechanism of soil preservation. The basis of conservation thinking is that man should work with nature and natural processes rather than in direct opposition to them. This basic concept may be translated into concrete practices by developing permanent vegetation of some sort for all land too steep to farm profitably or having such a soil texture as to be incapable of staying in place under agricultural conditions. In the eastern United States such a program requires the growing of forests, and in more arid sections of the country permanent grass or other ground cover is required. A cessation of drainage programs is desirable until a careful determination has been made of the present

value of the land and water and their products, the importance of undrained land in the storage of water, and the effect which draining may be expected to have on the reduction of flash runoff, not only locally but for the entire drainage area involved. Once a complete study is made, a comparison of present values with those that can reasonably result from the proposed drainage should determine whether or not the project is a beneficial one.

On lands devoted to agriculture, we must utilize the best available knowledge to prevent excessive erosion and to maintain soil fertility and productivity. Attainment of the desired goal may often require contour farming, terracing, strip cropping, grassing of runoff

strip, construction of farm ponds, and the employment of various other devices by which water is held on and forced into the land to the maximum possible extent. In areas that have been subjected to successive erosion, conservation requires a curative treatment involving gully control, check dams, and permanent vegetation.

Water

Acre for acre, water is often as productive a basic resource as land and the products of rivers, lakes, and ponds are equally valuable to the human race. The tremendous tonnage of fish, shellfish, and crustaceans used each year for human food and for other uses may be cited as one of the obvious values of areas covered by water. The natural water resources have been abused even worse than those of the land. Fisheries, particularly the inland and coastal bay fisheries, have declined tremendously due to overfishing, the blocking of streams by dams, pollution, or excessive erosion which has silted up the streams and lakes until they can no longer sustain the quantities and varieties of life that formerly thrived in these areas. Sometimes the decline of animal and even plant and human life is due to one of these factors alone but usually it is the result of a combination of two or more man-made troubles. Yet the productive capabilities are there; they have merely been abused.

There has been a slowly growing realization of the necessity for dealing with water control on the basis of an entire drainage basin rather than by isolated projects. It should be obvious that, in so far as possible, water management should start where the raindrop falls. To secure the greatest value from both land and water, agricultural and land management practices should be such as to retain as much rainfall as possible for use on the land. An understanding of this necessity has resulted in the development of a program of soil conservation which, by forcing water into the soil and by storing of water in small ponds, helps maintain ground water levels and takes maximum advantage of the combined produc-

tivity of the land and water. To the complete surprise of many people it is being demonstrated that water can often produce a value per acre that compares favorably with that obtainable from the best production in farm crops. Slowly we are commencing to realize that there are better ways of utilizing this country's natural resources than to drain water-covered areas solely to provide larger crops which may be already in surplus. A revolutionary change in the philosophy of the average farmer and land manager will be required, however, before the detrimental effects of indiscriminate drainage are recognized; we shall also have to change some of our past engineering practices. Among students of natural resource problems there is a conviction that a program combining good management of land and water over an entire watershed is the only possible way to stop the dissipation of the basic resources of the country. Obviously to carry out such a program it is unnecessary to advocate valley authorities, or the program of any particular organization or group of engineers. Regardless of which group or groups do the work, there should be no more piecemeal planning and construction of projects for flood control, hydroelectric power, or other purposes.

Conservationists do not believe that it is either good planning or good national economy to flood great areas of good farm land above a dam in order to furnish flood protection to the same or less acreage below the dam. They do not believe that big dams are the solution to this basic problem. They realize that big dams have a place but they believe that the best use that can possibly be made of water is for it to contribute the utmost from the moment it falls on the ground. They believe that these programs should come first; that control at the source will provide greater immediate values than great impoundments far down stream. They believe that proper land and water management will render many flood control dams unnecessary. They believe that such dams as are a demonstrated necessity will silt up much less rapidly and be of use for a much longer period if the management of water starts at the source.

In other words, groups studying this problem from the over-all standpoint — conservationists, soil experts, biologists — believe that the cart is before the horse when flood control and water management are begun far downstream instead of at water sources. They believe that such programs as have been common in the past are more expensive, less efficient, and less productive for public good than the more logical but less spectacular utilization of water, initially, from the time it first falls on the land. Conservationists believe that land and water management should be combined and started with the raindrop; they most certainly do not believe that the control of water should be delayed until it becomes necessary to deal with great volumes of water which already have become destructive forces.

Another great abuse is the pollution of water resources through the practice of dumping untreated industrial wastes and domestic sewage into the streams and lakes of the country. This abominable practice has been tolerated because it provided a cheap and easy way of solving an immediate problem. Yet, the food and recreational values thereby destroyed would often show a loss of public values far outweighing the gains which the offending industry or community may have obtained by its shortsighted and thoughtless procedure. Pollution has played a big part in the decline of the shad fisheries of the Atlantic Coast, the oyster fisheries of the Chesapeake Bay, the inland fresh water fisheries of the Illinois,

and other rivers. Through dumping sewage and industrial wastes the nation loses each year a staggering sum representing the value of the aquatic crops that could be produced in the absence of polluted waters.

Conservationists believe that no individual or groups of individuals has the right to destroy publicly owned resources needlessly or for their own immediate profit. Both from an economic and a public health standpoint, it is becoming increasingly important to clean up the polluted waters and thereby to protect human health and restore the biological productivity of part of our natural resource machinery.

There is one way to accomplish this program. It is necessary, first of all, to stop immediately any new pollution of water; it is then essential to put into effective operation a program for abating the existing sources of pollution.

The Role of Vegetation

Reforestation or revegetation is the first line of defense in both erosion control and water management. Too late has the public realized the mistake in cutting forests recklessly, and the wastefulness of allowing land to pass into an irresponsible ownership in which no thought was given to the future. Still, much progress has been made in the last 40 years in public understanding of the necessity of revegetation and much public money has been spent in buying back lands suitable for reforestation.

Much of the rough and poor land of the western states is in public ownership and capable of being managed in large blocks with maximum permanent return. The publicly owned lands in the West are valuable chiefly for timber production, watershed protection, and recreational purposes. Some of them have value for grazing, but many of the more arid regions quickly deteriorate when overgrazed, a mistake that is easy to make in an arid land particularly during a drought period. This nation should not make the mistake of allowing highly productive lands to pass into private hands for the purpose of exploitation or destruction, for ultimately they must then be brought back into public ownership for revegetation at great public expense. We should learn by the mistakes of the past. The rough and mountainous lands of the country, the arid grazing lands, and the

deserts that are not suitable for agriculture should always remain in public ownership where they can be managed for the protection of all interests and still be made to produce some return.

The basic concept of conservation may be said to be the permanent revegetation of all lands not suitable for agricultural development. Such lands in which rainfall is adequate should be restored to forests and when restored, they should be placed under a program of management such as will produce a sustained yield. In that form they will return their greatest value to the nation as well as to the community in which they are located. The more arid lands should be returned to grass or other suitable forms of vegetation.

One of the great mistakes of World War II was the plowing up of vast areas in the Great Plains country which, conservationists hoped, had been permanently placed in grass following the spectacular dust storms of the 1930's. Much public money was spent on the effort to vegetate these lands. Now with high prices and a little better rainfall, it has been profitable to gamble on cropping this land. It is a gamble and droughts will again return to the plains. Will these landowners have either the resources or the understanding to put the land back into grass once prices go so low as to render the gamble unprofitable or when drought begins to cut returns to the same point. Especially when our government supports a program of high farm prices it is a good guess that they will not and that the public will again be called upon to pay the cost of returning these lands to the only use for which they are basically fitted. The protective vegetation can be utilized for grazing by livestock or wild animals. It can be utilized permanently only if the vegetative cover is not destroyed by excessive use.

It is hoped that this brief discussion of the role of vegetation has pointed out the importance of plants in the management of lands and waters. Plants are one of the great natural controls since they are highly effective in retarding erosion and regulating runoff. They furnish an indispensable part of the mechanism by which a suitable water table is built and maintained; they build continually toward a more productive soil and they manufacture all the basic foods utilized by all animal life, including man. Can there be any questioning of the belief of conservationists that all land not immediately needed for other purposes should be kept continuously vegetated as a part of any intelligent program of natural resource management?

Wild-Life Management

Biologists and naturalists realize keenly that the ultimate fate of wild life is tied up inextricably with the management of the lands and waters. They realize that a good crop of wild life cannot be produced on poor and worn-out land any more than a good crop of cattle or corn could be produced on the same land. There is a popular belief that any piece of waste land is adequate for wild-life production. This belief prevails because wild life, often crowded into such areas, survives in minimum numbers on marginal areas. That does not mean, however, that good crops of wild life can be produced profitably on such land. For this reason wild-life biologists are keenly interested in maintaining the highest possible productivity of the lands and waters.

There are types of wild life fitted to live under almost all possible normal variations in vegetative cover and under varying climatic conditions. A reforestation program cannot but help certain types of forest animals. If that reforestation program is wisely carried out, the wild-life values are enhanced. As the timber grows, conditions become better for some forms of wild life and worse for others. A forest slows down runoff as duff accumulates. Streams which had become intermittent because of forest destruction, often become permanent streams once more as reforestation progresses. Likewise, in areas suffering from excessive erosion any sound program of soil conservation cannot but help wild life to some extent. If some thought is given to wild life at the time this program is laid out, this benefit can be multiplied many times.

Many flood control programs, hydroelectric developments and reclamation projects have been very destructive to fish and wild life. Often this has been needless since experience shows that some consideration would have provided an opportunity to salvage many fish and wild life values.

Although one on which it is difficult to evaluate in a monetary sense, the greatest single benefit of wild life is the incentive it affords man for wholesome outdoor recreation. The outdoors still has a major appeal. People go out-of-doors not only to hunt and fish, but to look at and photograph birds, mammals, and scenery. Their

methods of enjoying these resources are diverse and that is one of their most wholesome values. There has been an epigram circulated for many years that more film is utilized in photographing wild life than is used on any other subject except babies. A total of 9,854,314 hunting licenses were sold in the United States during 1946 and 11,068,717 fishing licenses were recorded in addition. This is a record amount, but the number of such licenses has grown steadily each year since 1918 when records first began to be kept on a wide scale. Yet these numbers represent only those who are required to obtain a license to hunt or fish; they do not include the great many who can hunt or fish without licenses, nor those who get their fun out of wild life in other ways.

From an economic standpoint, however, wild life is also of great value to the country. The fish and other products taken from the streams, lakes, and coastal waters of this country amount to from four and five billion pounds a year. They furnish a source of wholesome protein food that costs little to produce if the nation gives nature a chance and works with her rather than against her. The only thing the human race is called upon to do to preserve the fisheries is to refrain from destroying the environment on which the fish depend and to regulate their take out of the fish populations so as to leave adequate breeding stock. It seems small enough an investment to guarantee such a quantity of wholesome and nutritious food. A rather hasty survey has shown that the combination of overfishing, drainage, pollution, and siltation of streams and lakes has cut a potential two billion pounds a year from possible commercial production.

While engaged in recreation, hunters and fishermen take approximately three-quarters of a billion pounds of meat and fish annually in this country. This harvest could be appreciably increased if intelligent management were applied to the lands and waters.

Fur-producing animals furnish the incentive and the economic return which pioneered much of this land and the fur taken in the United States under present lack of suitable environment and depleted stocks of fur bearers still aggregates $50,000,000 to $60,000,000 a year. It could be several times that much if this resource had been managed more wisely. There are acres of marshlands, for example, that produce more net return per acre in muskrat fur alone than similar land produces when drained and placed under cultivation.

In addition to these direct values, there is a tremendous business, estimated at two billion dollars annually, in furnishing accommodations, and in providing outdoor clothing and hunting and fishing equipment to those seeking recreation and relaxation in the outdoors. It is one of the major businesses in the country and has a peculiar value in placing much of the money expended for this purpose in the remote and poorer sections of the country. With lands revegetated and properly managed, this business can be increased.

The basic concepts may be summarized as follows: Conservation involves wise use of renewable resources of the country so as to obtain a perpetual harvest of the production of the lands and waters. Profitable production of American farms and forests can be maintained only by adequate management of the soils to prevent destructive erosion. Water control and land management should go hand in hand and should start from the moment rain falls on the land. There should be a co-ordinated program over an entire watershed in order to maximize the benefits of conservation. So far as possible, water should be stored in the land where it falls and it should be used to produce crops, to keep the stream flows regular and steady, and to provide ground-water supplies for human and agricultural use. No more land should be drained without careful consideration of its value in the over-all management of water and its total productive capacity before and after drainage. No more pollution should be permitted to start and existing pollution should be cleaned up as rapidly as possible. Once the pollutants have been removed, polluted waters are capable of producing as great a crop of fish as ever. All lands too steep, too light, too sterile to be used profitably for intense agriculture should be revegetated. In the more humid areas lands must be reforested; in the arid sections grass or some of the more arid land plants will have to be restored. The imperative need is to maintain an adequate vegetative cover on all lands not needed for more intensive use. Problem areas, in particular, should be maintained in grass cover even at the expense of some incidental uses which might be obtained from them. Wild life is a crop that must be grown the same as any other crop; its production can be integrated with intelligent and better management of lands and water. The recreational value of wild life is intangible but tremendously important; the monetary and economic value amounts to billions of dollars annually.

The intelligent management of renewable resources is the major problem before America today. While the strikes, divorces, murders, baseball games, and many other features fill the headlines and attract momentary attention, the future of this country depends upon how well its remaining resources are managed, and how effectively the resources can be restored where ignorance, greed, or stupidity have destroyed their productivity.

Aerial Dimension

Man Finds Aviation in the Process of Boldly Altering Many Aspects of Contemporary Civilization in Recompense for Flight

By Paul Meadows

THROUGH aviation the third dimension is daily recognized as a salient element of modern existence. Through aviation the two-dimensionality of industrial peoples has been intensified and facilitated. Aerial technology has created a new tempo and a new temper in industrialism. Moreover, it accelerates a culture which must be and is becoming air-conditioned. This change in the face and spirit of contemporary civilization, still in process and in prospect, may be seen from at least four points of view: geographical, industrial or social, political, and psychical.

Aerographic Conception of the Earth

First of all, the aerial dimension of modern man is bringing him to a new, an aerographic, conception of his earth. This new orientation to the earth can be seen in the new maps. A map is a picture of space. Historically, the map shows the widening knowledge of the globe which comes from exploration, pioneering, industrialization. Sometimes map makers lie, consciously or unconsciously. "Attention is necessarily directed," General McClellan of Civil War fame once wrote, "to the erroneous maps in our possession." An Air Corps general can make the same comment about most of our present-day global maps. In preaviation days, we became accustomed to flat, Mercator projections. They showed regions of the globe, nicely patterned into isolated continental systems of land masses and bodies of water. Such a projection is primarily designed for the construction of nautical charts where course bearings are of principal concern. From the point of view of an aerographic conception of the earth, the Mercator type of map, always artificial, is obsolete and misleading as well, particularly as regards the relative areas near the two Poles.

Wrote Antoine de Saint Exupéry in his *Wind, Sand and Stars:*[1] "The airplane has unveiled for us the true face of the earth." In preaviation days, when men's activities were bound by land and water, the distortions of a Mercator map were rather unimportant. Aeronautically, however, a new global picture has become imperative. For example, a map which focuses on the North Pole and arranges land and water systems around that center, polar rather than Mercator projection, is of revolutionary value to aerially minded people. It not only lays out new routes of world travel, the Great Circle route of Northwest Airlines, Inc., for instance, but it reveals a new earth for that hemisphere which contains by far the major portion of the world's inhabitants. Cartographers speak of it as a monospheric earth.

It is recognized, of course, that no system of depicting the global earth on a plane is completely satisfactory. Moreover, various types of projections best serve the conflicting requirements which the cartographer must face. For the purpose of this article we may neglect consideration of such technical details and say that a monospheric map corresponds with aerial reality. The aerial dimension must deal in time-distance advantages, the only kind it has over surface transport, and these come from adherence to the routes which are the shortest distance between two points. It may be some time before northward flights across the top of the globe are economically feasible on a mass scale, but for most of the world's population long flights necessarily traverse polar regions. Such flights bespeak the logic of the air. The time-shrinkage of the earth — no point on the earth's surface more than 50 hours away from any other, we are told — is more than a by-product of the airplane: It is literally the geographical revolution which William A. M. Burden, Assistant Secretary of Commerce, once said is contained within the airplane itself.

Aerial travel has revealed to us not only a new earth but a new heaven. We have come to understand that the atmosphere has a topography of its own: The survey of the "surfaces" of the air, so to speak, has become a task no less dramatic, and probably far more daring than has been the study of the land or sea. "Things are queer in the upper reaches," comments one of Saint Exupéry's characters. Such problems as are presented by flight in the stratosphere, breaking the supersonic barrier, or the recording and prediction of weather on a global scale, call for skills at least as learned, planning at least as comprehensive, teamwork at least as extensive, and heroism at least as bold as was ever reported in the annals of land and sea explorations. Better still, the work has just begun.

"Aviation," according to Charles Hurd, New York journalist and aviation specialist, "is recasting our maps, rewriting our geographies, and upsetting our sense of direction."[2] His reference is not merely to the fact that aviators, like the cowboys of the 'Seventies and 'Eighties along the Chisholm trail, are pointing northward. He alludes rather to the characteristic that, unlike surface transport, aerial travel has no absolutely necessary discontinuities. Only in part do the continuities of the air come from the absence of aerial barriers. As British geographer, James Fairgrieve, has pointed out,[3] they arise also because the lands north of 30 degrees, grouped around the Pole, are along Great Circle routes and are fairly continuous. These lands are likewise those of greatest human settlement and industrial development. An air map of the world, as American Airlines, Inc. demonstrated in their famous global map, does not divide the air into parts; the

[1] New York: Reynal and Hitchcock, 1939. $2.75.

[2] Weigert, H. W., and Stefansson, V., "World Airways," *Compass of the World.* (New York: The Macmillan Company, 1944), $3.50. Page 109.

[3] Weigert and Stefansson, "Geography and World Power." *Opus cited,* page 190 ff.

aerial component of modern civilization is one unit, unbounded and universal.[4] The modern aviator, like Saint Exupéry's friend, Mermoz, who flew the trans-Andean air mail in the early days, is engaged in throwing bridges across the Saharas, the Andes, the Seven Seas — indeed across the entire world.

In 1755, George Washington wrote: "I herewith send you a small map of the back country." The American airman's back country has changed tremendously, both in scope and location, in the two centuries since surveyor Washington wrote his letter. What was once a global back country promises to become little more than a global backyard.

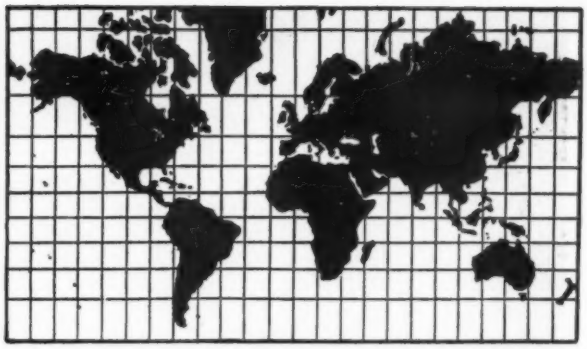
Aerodynamic Conception of Industrial Society

It is also appropriate to say that the aerial dimension is bringing to modern man what we may call an aerodynamic conception of his society. Modern Western culture is industrial in character. This is to say that it is globe wide in its dependence and globe wise in its aggression. A global product itself, the airplane is both a symbol and an agent of technological advance. Machine technology accents speed and power: It fosters the use of mechanical power for increasing the speed of movement of both men and materials. Speed through space, through process, through time are all expressed in aeronautics, in conscious means for reducing the contraction of time, distance, and cost. In terms of travel time, the shrinkage of distance was given impetus by the war but it becomes no less imperative in peace. A society whose members may travel at, or even beyond, the speed of sound is no idle dream but an imminent military and civil reality.

The aerial assault on space and time has already had, and will unquestionably continue to have, some very striking social consequences.

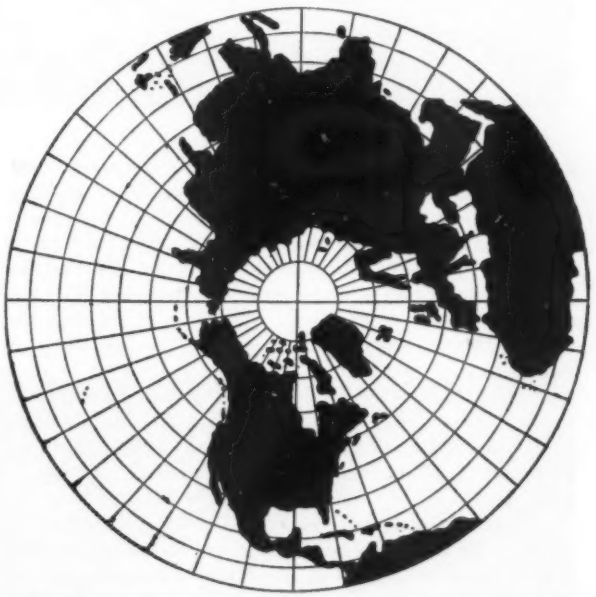
Its impact is most notable, of course, on the transport of men and materials. The air wing of industrial civilization, aside from (and perhaps in spite of) its manifest military values, is fundamentally a transport vehicle. Chicago sociologist and aviation specialist, William F. Ogburn, has found that scheduled transport of passengers in the United States showed an annual rate of growth in passenger-miles flown of 30 per cent for the 1930 decade.[5] He has estimated that by 1953 between 6,000,000 and 8,000,000 passenger-miles will be flown annually. He has extrapolated air cargo data and has suggested that very probably 15 to 20 times as much cargo will be flown in the first few years after World War II as was carried in prewar years. His forecast for international travel for the latter part of the postwar decade is for from 650,000 to 1,000,000 passengers. Aerial transportation not only makes possible the opening up of new markets in distant areas but it stimulates business activity. Partly as a result of the new markets, which it alone can reach, Ogburn holds that aerial transportation will undoubtedly speed up already existing trends in marketing; it will enhance special orders, specialty goods, direct selling from producer to retailer, national and international markets, and can quicken business transactions.

The new agencies embodied in aviation have certain inevitable effects on technological change. Concerning the processes of technological innovation enough evidence has been accumulated that predictions can be made intelligently. Modern industrialism not only builds on the foundation of past inventions in a given field but it promotes the transfer of a technology from one field to another. Concretely, aviation would have been altogether impossible without the internal combustion motor. But with the aid of the aerodynamics learned from the utilization of the gasoline engine, technologists have gone on to develop jet propulsion; an age of rocketry is, without question, in the offing. In the same manner, the aerial technologies have been put at the disposal of other tech-



No plane representation of any appreciable portion of the earth's surface is without objectionable distortion. The type of map most suitable for any purpose depends in large measure therefore on the principal uses to which such diagrammatic representation is to be put.

Mercator's projection of the world, shown above except for extreme polar regions, correctly portrays directional courses, and therefore became a popular type of map when voyages to the New World opened up to exploration vast new continents toward the end of the Fifteenth Century. Regions near the polar regions are greatly exaggerated in size, however, as is indicated by examination of Greenland.



The preponderate amount of air travel has tended to follow great circle routes over the Northern, and more heavily populated, Hemisphere. Any one of many possible polar projections, such as the Lambert projection shown here, emphasizes the importance of arctic travel and is superior to the Mercator projection in reducing distortions for that part of the globe which is of primary concern in long-distance air travel.

[4] Hutchison, Keith, *Freedom of the Air*. Public Affairs Pamphlet #93. (New York: New York Public Affairs Committee, 1944.)

[5] Ogburn, William F., *The Social Effects of Aviation*. (Boston: Houghton Mifflin Company, 1946), $5.00. Pages 118–120.

A global product itself, the airplane is both a symbol and an agent of technological advance. Aviation would have been altogether impossible without the internal combustion engine. But with the aid of the aerodynamics learned from the utilization of the gasoline engine, technologists have gone on to develop jet propulsion; an age of rocketry is, without question, in the offing.

Photo by Samerjan from Black Star

nologies including mining, agriculture, forestry, conservation, and, of course, war. The employment of aviation will be indispensable in the development of new mines and mining areas, for making aerial surveys for mineral deposits, for flying in supplies and flying out ore, for transporting workers, and for many other uses. The airplane has already proved its usefulness in dusting and spraying fruit, vegetables, trees; in sowing seed; in mosquito and rust abatement; in soil surveys; in river valley development work; in wild-life inventory and predatory control; in forest fire fighting. Already airplanes have taken off the cream of land-borne and water-borne transportation. Charles Hurd has observed, "Sooner or later, they will dip down into the milk." [6]

No less dynamic have been, and will be, the effects of aviation on certain human aspects of industrial civilization. The interchange of cultural items through trade, the exchange of cultural ideas through travel, the mutual flow of purpose and plan can hardly be stopped, although it may be postponed by iron curtains dropped here and there on the globe. Industrial culture, like water, will seek its level, and in an aerial civilization it is a rising level of industrial art and aspiration. Death rates will go up from war and accidents, but they will be pulled down by aerially transported medicines, food supplies, and knowledge. Population will continue to flow, as it always has, along the lines of travel, and new settlements will be opened up along the air routes. The cultural dominance of the great cities will inescapably widen; indeed, it has already. New threats to public health from air-borne causes and new problems for medical research are emerging. The airplane is already competing with the automobile as a mode of recreation, and the public, both spectator and participant in competitive sports, is yearly being enlarged. Sadly enough, aerially mediated crime — smuggling and the disposal of stolen goods and of criminals — must be debited against the airplane.

The hastening tempo of existence in the air age is both an index and the agency of the evolution of industrial civilization. Sociologists are fond of saying that a society is coterminous with the limits and speed of communication. An aerodynamic society is beginning to discover, how literally, perhaps also how magnificently, true that statement is!

Aeropolitical Conception of the State

The aerial aspects of modern industrialism are leading to a transformation in the contemporary thinking about the state, to an aeropolitical conception of the state.

Sociologist Hornell Hart of Duke University has worked out an interesting correlation between the speed of transportation and the size of empire: The faster the transport, the larger the empire can be. Whether this association is, or will continue to be, true in the field of political behavior, it should be quickly apparent that the airplane has magnified our realization of the land and water boundaries of the nation-state representing political discontinuities of the earth's surface. The aerial maps may not show them, but in point of fact there are all kinds of boundary lines staking off the sky's dimensions. Air routes are not merely commercial; they are perhaps, even more significantly, political and military.

In 1902, Paul Fauchille, French jurist, opined: "The air is free. The states have no authority over it in time of peace or in time of war other than that which is necessary for their own preservation." [7] However, World War I made another thesis more urgent, and in the Paris Convention of 1919 the first clause read: "The high contracting parties recognize that every power has complete and exclusive sovereignty over the air space above its terri-

[6] Weigert and Stefansson, "World Airways." *Opus cited*, page 113.

[7] Hutchison, *opus cited*.

tory." Freedom of air passage and the establishment of what was then called "international airways" was made conditional upon the consent of "the states flown over." In spite of the International Civil Aviation Conference which met in Chicago in November, 1944, with 54 nations attending and despite the agreements of that Conference, tremendous problems remain to be solved, as may be seen in the fact that a world system of airways is not yet, and perhaps may never be, a matter of fact.

The difficulty is only partly economic. In 1927, General Baranov, then head of the Soviet Air Force, took occasion to explain that the development of a network of air lines "is one of the most powerful methods in the struggle for new markets." [8] The struggle for airways is highly competitive, company against company, nation against nation. But the economic subtly shades into the political, and "the freedom of the air" becomes a weapon of the political state no less than did "the freedom of the sea."

The influence of Mahan on our thinking about the importance of the air is very marked, as Eugene Wilson, of the United Aircraft Corporation and chairman of the Board of Governors of the Aircraft Industries Association, has pointed out.[9] Admiral Mahan's doctrine of sea power posited a "fleet-in-being," backed by a merchant marine and a seafaring people. Similarly, the contemporary doctrine of air power, aside from the verbal battles over sea *versus* air power, builds on the Mahan pattern. If capable of supporting a military and industrial establishment of any size, the modern political state cannot avoid seeing the advantages in a commercial air-transport system able to back the air fleet if, and as, it may be aided and abetted by an air-faring people.

[8] Hershey, Burnet, in *Skyways of Tomorrow*. Headline Series, #47. (New York: Foreign Policy Association, 1944), page 42.

[9] Stuart, John, in *Wings over America*. Public Affairs Pamphlet #114. (New York: New York Public Affairs Committee, 1946.)

In many ways so modern a thing as the geopolitics of Germany's geographer, Haushofer, has already been rendered passé by the airplane. His geographical and political creed, more or less followed by the Nazis, was thoroughly dominated by what Eugene Staley has so appropriately called "the myth of the continents." [10] Possibly, the Mercator maps are mainly responsible for his belief in the continental system of isolated land masses neatly arranged in a descending order of importance around the Asiatic "Heartland." Haushofer to the contrary, today, in the aerial age, he who controls the polar approaches controls the world. That fact brings all regions of the world into vulnerable relationship with one another. The whole concept of buffer states needs a polar reorientation. Likewise, the myth of hemispheric defense must sooner or later come to terms with the highly lethal strategies of monospheric offense *via* air.

General H. H. Arnold, reviewing American aviation history, put the aeropolitical conception of the nation-state on a time scale which, unfortunately, too few people really understand. "In this spectacular conquest of time we have already on the horizon the techniques which, when realized, will cause us to measure distances in terms, not of miles, but minutes." [11] The power and the vulnerability of the modern state which this fact implies, particularly in an age which must be called atomic as well as aerial, can only give mature minds a painful pause.

Aeropsychic Conception of Human Living

Finally, the aerial dimension of modern industrialism is succeeding in crystallizing, perhaps none too perfectly, an aeropsychic conception of the human being and his way of living. It is impossible to catalogue all the ways in which the airplane is entering, (*Continued on page 178*)

[10] Weigert and Stefansson, *opus cited*, page 89 ff.

[11] *Air Force*, November, 1946, page 13.

As if astonished at the changes which have been brought about in human relations by progress in aviation, the nose of this plane assumes an almost human expression, appearing to gaze heavenward with open mouth.

Already airplanes have taken off the cream of land-borne and water-borne transportation; soon they will dip down into the milk.

Photo by Samarjan from Black Star

Faculty in Relaxation . . . . .

MORE than two dozen talented Faculty members at M.I.T. displayed art objects of their own creation in a Faculty Club art exhibit which was held in the lobby of the Rogers Building during the early part of December. Since the exhibit was intended primarily for the display of the creations in the field of art (excluding photography for which a separate exhibit was provided last spring) it represented only a part of Faculty interest and participation in general extracurricular activities. Nevertheless, in focusing attention on the artistic pursuits of the M.I.T. Faculty, the exhibit demonstrated with ample force that engineers and scientists do not differ radically from other well-rounded individuals in spite of the rigors of their work. Broad interests in fields other than those of narrow specialization are especially important among those who aspire to lead and to educate.

As might have been expected in an art exhibit, oil and water-color painting led the field, both in number of entries and also in the number of artists whose work was represented. Some of these bore the air of a professional touch as did also a group of pen and ink book illustrations. Pencil sketches were also in evidence and one man whose professional background is in biology surprised his colleagues with the quality of etchings he had made. As for subjects chosen for artistic expression, these ranged from portraits and landscapes to animal life and modern abstractions.

Artistic talent and appreciation were displayed in related fields as well. A number of Technology's academicians found relaxation in woodwork. Delightful wood carvings of birds and four-footed animals, along with an example or two of ivory carving, were the product of one member. Another chose to supplement his utilitarian handicraft by illustrating the progressive steps in the carving of briar pipes.

Pottery work made and decorated by a research worker, hand-painted china by a mechanical engineer, and portrait heads in terra cotta by a professor of metallurgy gave a certain air of practicality to the Faculty's display of artistic ability. Representing the practical arts pursued by M.I.T. teaching and research staff were examples of bookbinding and Indian figure weaving. Few who viewed the exhibits illustrated on this page would otherwise suspect the considerable talent shown by one professor of electrical engineering (*Continued on page 180*)

. . . . . Students at Play

ATHLETIC contests with other New England colleges provided the focus for a week end of play at M.I.T. when 1,400 students and guests set aside December 5 and 6 for a program of healthy recreation. The event, known as Techsapoppin, was intended to bring to M.I.T. some of the social and athletic events which are contributing factors in the development of well-rounded individuals. The Administration has recently provided expanded facilities and personnel for advancing intramural and intercollegiate sports as a major part in a program to give the Technology student a more complete school life, and consequently it encouraged student initiation and management of the Techsapoppin week end.

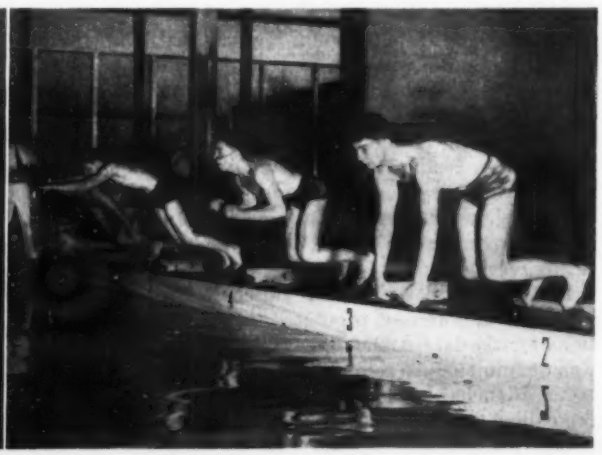
The week end began at 8:30 on Friday evening, December 5, with a basketball game in which M.I.T. played Boston University at Mechanics Hall in Boston. An informal Saturnalia dance followed the game which was won by Boston University. During the dance, a student board of judges selected a group of candidates present from which the Queen of Techsapoppin and Six Princesses of Sports were to be chosen on the following evening in the Great Court.

On Saturday, December 6, Techsapoppin events began at 1:45 with a fencing exhibition in Walker Memorial. The M.I.T. Fencing Team, which was undefeated and won the Eastern Intercollegiate Championship last year, put on such unique matches as a dagger and sword bout and a duel on roller skates.

At 2:30 the M.I.T. Wrestling Team met Brown University in the State Armory on Massachusetts Avenue, opposite Technology. The Alumni Pool was the scene of another M.I.T.-Brown contest. In the third intercollegiate contest of the afternoon M.I.T. defeated Wesleyan University in squash.

At 7:30 on Saturday evening, a large and enthusiastic group gathered in the Institute's Great Court to witness the final selection and crowning of the Queen of Techsapoppin. A Wellesley College senior, Miss Dorothy Williams, was named Queen by a jury consisting of Karl T. Compton, President of M.I.T., Francis W. Dahl, cartoonist for the Boston *Herald*, and John R. Powers of the Powers Model Agency. The six Princesses of Sports were all from schools in Metropolitan Boston.

Private automobiles and chartered busses carried the students to the Boston Arena where M.I.T. played the New England Intercollegiate Champions of Boston University in a hard and fast hockey game in which Boston University won over the M.I.T. team. The fraternities held open house after the game until the week end was officially brought to a close. (*Concluded on page 182*)



THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

Zinc in Your Veins

GATHERING for the 259th meeting of the Alumni Council in the Graduate House on November 24 were 117 members and guests, Raymond H. Blanchard, '17, President of the Alumni Association, presiding. Bernard P. Gregory, formerly an officer in the French Army, and now a graduate student in physics and electrical engineering, was the student guest introduced by Professor Avery A. Ashdown, '24. Christian J. Matthew, '43, took a bow as new alternate member on the Alumni Council, and E. Charlton Crocker, '43, newly elected representative of the M.I.T. Association of Japan, made an appeal for technical publications of any kind published within the last decade, to be transmitted to Japan where they will become a permanent part of the library of the Imperial University of Tokyo.

In the secretary's report, Charles E Locke, '96, reported that since the last Council meeting, 25 Faculty and Alumni members of the staff had paid visits to 16 local M.I.T. clubs, geographically distributed from Havana to Wellesley, Mass., and from the Atlantic Coast to Dallas. Professor Locke also announced that the executive committee proposes to set up a sample constitution to serve as guide for classes about to be graduated and also for older classes who may wish to adopt such a constitution for the conducting of their class activities.

President Blanchard called on H. E. Lobdell, '17, Executive Vice-president of the Alumni Association, who gave a brief and stimulating report of his recent visits to a number of clubs as far south as Havana. Mr. Lobdell reported that the clubs he had visited were all active and very much interested in affairs at M.I.T. In particular the M.I.T. Club of Cuba was welcomed as a newly formed group of loyal, active, and exceedingly hospitable Alumni.

William W. Garth, Jr., '36, chairman of Alumni Day 1948, reported that the organization of his subcommittees was practically completed and that details of the Alumni Day program were approaching final shape. Full announcement regarding Alumni Day committee membership and program will appear later in The Review.

Robert C. Casselman, '39, chairman of the Committee on Assemblies, reported that arrangements for the Midwinter Meeting of the Alumni of Metropolitan Boston, to be held in Walker Memorial on Saturday, February 7, 1948, were progressing satisfactorily. He promised an attractive show or demonstration comparable to the television demonstration of last year which was enthusiastically received.

Professor John B. Wilbur, '26, chairman of the Committee on Resolutions presented the committee's resolutions for the late Arthur G. Robbins, '86, which report was unanimously accepted by a silent rising vote.

Mr. Blanchard then read a letter from President Compton calling attention to the suggestion, made by members of the Advisory Council on Athletics, that this Advisory Council be replaced by a new Athletic Board, and requesting the Alumni Council to nominate two members to serve on this newly created Athletic Board. The Alumni Advisory Council on Athletics has faithfully carried responsibility for the general supervision of student athletics for half a century and the replacement of this group by a new organization was done with some nostalgic regret. At the same time, the Advisory Council on Athletics had realized for some time that enlarged postwar enrollment at M.I.T. made another type of organization better fitted to conduct the athletic needs of present-day students. The formation of the Athletic Board is treated in greater detail on page 162.

In speaking of current developments at M.I.T., President Compton discussed what he called "operations analysis" pointing out that since it is based on a thorough study of operations of a complete or over-all system, operations analysis, to some extent, tends to envision the future. Operations analysis is an effective means of studying all significant activities of an entire system. It was employed during World War II with gratifying results, as reported by Philip M. Morse in the November, 1946, issue of The Review. At the present time, the Institute is co-operating with the Navy in further developing research and training programs for operations analysis. There are possible applications to many broader fields than have thus far been investigated. President Compton humorously implied that the general method may even be applied to an examination of the functions and operations of M.I.T. itself.

President Blanchard then introduced Robley D. Evans, Professor of Physics at M.I.T., who spoke on "Some Recent Medical Applications of Radioactive Isotopes" from the point of view of the physicist rather than of the physician. He traced the growth of the Radioactivity Center at M.I.T. from 1934 to the present time when about 50 persons are employed on research projects using equipment worth about $330,000 in a program which calls for an expenditure of $15,000 monthly. To date, some 200 technical papers have been produced at an average cost of between $1,000 and $2,000 each — 23 per cent of which have been applied in the field of medical research.

An important medical application of radioactive isotopes is their employment to tag or "paint" atoms so that their individual movements can be traced. For example, use may be made of three typical radioactive batches of iodine. The atoms are synthesized into molecules and the position of the individual molecules can be detected and traced by Geiger-Müller counters. The problems to be solved in such a project require the co-operative teamwork of groups trained in widely different fields. But through such co-operation many problems yield to analysis, not only in the medical field but in other fields as well.

For example, by using radioactive ball bearings it is possible to determine how many atoms come off a ball bearing in the process of rolling across a metal block.

By radioactivating sulphur, it becomes possible to study the progress of sulphur through the coking process of coal. Analysis of the radiation as radioactive particles are lowered into the earth provides a method for logging the composition of the earth's surface, even in a cased oil well where there is no direct access to the strata.

One of the most recent studies which have been pursued at M.I.T. and elsewhere has been on radioactive zinc which started with the study of white cells in the blood. The successful use of radioactive tracer atoms in investigations of the red blood cells and the causes of anemia has initiated studies of the behavior of white blood corpuscles. A procedure for separating the white from the red blood cells was first developed. Spectroscopists then found that although present in a very small amount, zinc was the predominating element in the white cells. Radioactive isotopes of zinc were next prepared, injected into the blood stream, and their course through the body was observed. By means of such tagged radioactive zinc atoms, it was discovered that radioactive phosphorus retards the propagation of white cells. It was also found that the amount of zinc in the white cells of persons suffering from leukemia is only 10 to 20 per cent as much as in that in the white cells of healthy persons, and that leukemia patients have a great excess of white cells. Research now going on appears to give good promise for overcoming leukemia by the use of zinc in some way not yet fully ascertained. The work, still in its early stages, is advancing through the wholehearted co-operation of scientists in several fields at M.I.T. and elsewhere. The progress in research which was reported by Professor Evans' stimulating address gives encouragement that the physicists' study of elementary particles has results as beneficial as the military uses have been devastating.

Fiscal 1947

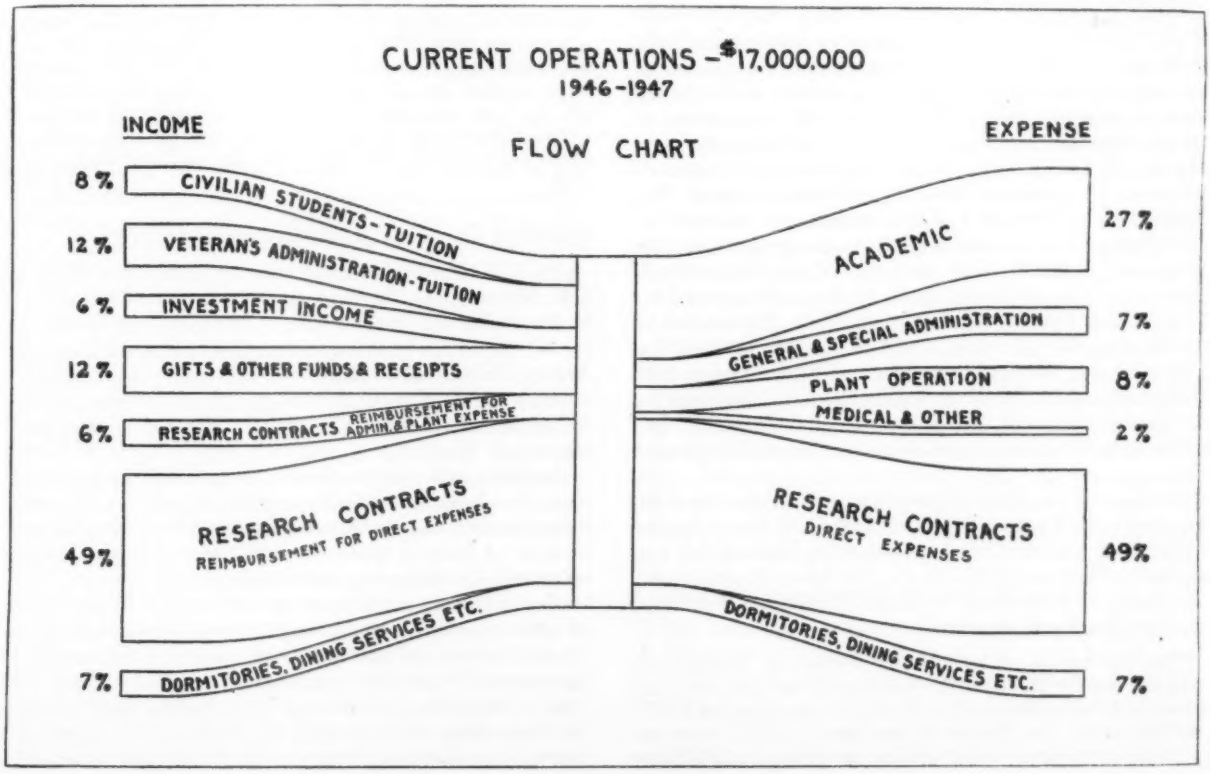
IN presenting the financial report on M.I.T. activities for the fiscal year 1947, Horace S. Ford, Treasurer, was able to report that a $17,000,000 volume was conducted with a deficit of only $4,784 instead of almost $300,000 which had been anticipated earlier in the year. The favorable showing is attributed largely to increased income from investments and to more favorable revenues from research than had been anticipated, although some of the additional income also came from increased tuition rates and the year's unprecedented enrollment.

With the great increase in the student body, the usual academic operations expanded greatly, reaching the figure of $6,500,000 for the year reported, as contrasted with $4,000,000 in 1946.

Endowment and other funds showed an increase of $1,000,000 during the past year and have a book value of $47,500,000. Gifts for endowment during the year totaled $328,374 with gifts for building funds amounting to $1,110,334. Student loan funds and other gifts brought the total up to $2,383,682.

The flow chart, below, shows the sources of all income and expenses for the year which ended June 30, 1947. Income from students, including loan and scholarship awards amounted to $3,431,000 which represents an increase of $1,526,000 over the previous year. Two thirds of the income from students came through the Veterans Administration Office. Income from investments reflected increased stock dividends received and represents an increase of $126,000 over 1946. Revenues from research contracts were $9,825,000 compared to $24,200,000 for the year 1946.

Academic and educational expenses increased about


CURRENT OPERATIONS – $17,000,000
1946-1947
FLOW CHART
INCOME
EXPENSE
8 % CIVILIAN STUDENTS - TUITION
12 % VETERAN'S ADMINISTRATION - TUITION
6 % INVESTMENT INCOME
12 % GIFTS & OTHER FUNDS & RECEIPTS
6 % RESEARCH CONTRACTS REIMBURSEMENT FOR ADMIN. & PLANT EXPENSE
49 % RESEARCH CONTRACTS REIMBURSEMENT FOR DIRECT EXPENSES
7 % DORMITORIES, DINING SERVICES ETC.
ACADEMIC 27 %
GENERAL & SPECIAL ADMINISTRATION 7 %
PLANT OPERATION 8 %
MEDICAL & OTHER 2 %
RESEARCH CONTRACTS DIRECT EXPENSES 49 %
DORMITORIES, DINING SERVICES ETC. 7 %

$1,500,000 during the year. General and special administrative expenses were $242,000 over the corresponding figure for the previous year, and plant operation and maintenance totaled $828,000 or $202,000 more than the year before.

It is interesting to note from the flow chart that 20 per cent of the Institute's income was derived from tuition, whereas 27 per cent of its expenses were for academic salaries. Plant operation, medical service, and general and special administrative expenses account for another 17 per cent of Institute expenses — all of which are needed to serve students properly. Hence, on a percentage basis, the income from student tuition accounts for less than half of the expenses needed to maintain the educational requirements at M.I.T.

Midwinter Boston Meeting

ALUMNI of Metropolitan Boston will hold their Midwinter Alumni Meeting at Walker Memorial on the evening of Saturday, February 7, 1948. Cafeteria style dinner will be served between 6:00 and 7:30 P.M. and the program of events will begin at 8:15.

An interesting lecture and demonstration will be given by George W. Gilman, '23, Director of Transmission Engineering for the Bell Telephone Laboratories. The program has been planned to acquaint Boston Alumni with some of the newer techniques and recent progress in telephone communications, including the microwave relay between Boston and New York which has been completed only recently.

Robert C. Casselman, '39, chairman of the Committee on Assemblies, promises a program as interesting as last year's when about 1,000 Alumni came back to Tech for a demonstration on television.

Athletic Board Replaces Advisory Council

REPLACING the Alumni Advisory Council on Athletics, which for half a century has functioned as the supervising agency of M.I.T. athletics, is the newly created Athletic Board. Formed at the suggestion of members of the Advisory Council on Athletics, the new Board will broaden the range of interests and responsibilities in the guidance of M.I.T. athletic activities. The Board will be composed of two members nominated by the Alumni Council, two members to be appointed by the President of M.I.T. from the Institute Faculty or staff, three members to be nominated by the Athletic Association, and, ex officiis, the dean of students, the director of the Medical Department, and the director of athletics. The increased enrollment at the Institute, coupled with the general objective of providing expanded facilities for developing students into well-rounded individuals, has made such a move particularly desirable at the present time.

At the meeting of the Alumni Council on November 24, Dr. John A. Rockwell, '96, chairman of the Advisory Council on Athletics, read the following letter which was signed by William W. Garth, Jr., '36, Lewis T. Jester, Jr., '41, Henry E. Worcester, '97, Ralph T. Jope, '28, Secretary, and Dr. Rockwell, chairman:

> The first meeting of an Advisory Council on Athletics was held on January 18, 1898. The Advisory Council in its present form has been functioning as the supervising agency of M.I.T. Athletics since the Hunter Report about thirty years ago.
>
> As the years have passed and the enrollment at M.I.T. has grown, the responsibilities placed upon the Council have also increased. Therefore, last year members of this Council recommended to the Administration that a full-time Director of Athletics be appointed. Since this suggestion has been accepted and the M.I.T. Administration has assumed the full responsibility for supervising M.I.T. Athletics, the need for an Alumni Advisory Council on Athletics in its present form no longer exists. Consequently, members of this Advisory Council request that they be discharged and this Advisory Council on Athletics be discontinued as a standing committee of the Alumni Council.

Following Dr. Rockwell, two other long-time members of the Advisory Council on Athletics — Henry E. Worcester and Ralph T. Jope — spoke of the work the Council had done over a period of years for the benefit of student athletics at M.I.T. Both stressed the pleasure they had enjoyed in being able to participate in this important work throughout their many years of association with student athletics.

It was then voted "that the Advisory Council on Athletics be discharged with full recognition and tribute for the fine services rendered, and that William W. Garth, Jr., and Lewis T. Jester, Jr. be nominated by the Alumni Council as the two alumni members for the first annual appointment by Dr. Compton."

In speaking of the postwar conditions which made it desirable to alter past methods of conducting athletic activities at M.I.T., President Compton told the Alumni Council:

> The necessity for the adoption of this new plan points to the great responsibilities which the Alumni Advisory Council has borne over a long period of years. This Advisory Council has been responsible for formulating and maintaining the high standards which characterize our athletic activities at the Institute, and it has, despite inadequate funds, steadily improved and enlarged the scope of athletics at the Institute. The present enlarged program, with its emphasis on intramural athletics, is a tribute to the Advisory Council's effective planning and administration I would pay particular tribute to Dr. Rockwell, who has been chairman of the Advisory Council for 33 years and a member for 49; to Mr. Worcester, who has been a member for 33 years; and to Mr. Jope, who has been secretary since 1934.

Physics in the Contemporary World

APPROXIMATELY 1,000 persons gathered in Walker Memorial on the evening of November 25 to listen to Dr. J. Robert Oppenheimer, Director of the Institute for Advanced Study at Princeton, N. J., deliver the second Arthur Dehon Little Memorial Lecture. This scholarly address, dealing with current problems in the proper utilization of science was entitled "Physics in the Contemporary World."

Speaking with conscientious concern about the applications to which scientific knowledge is put, Dr. Oppenheimer stated that "a scientist cannot hold back progress because of fears of what the world will do with his discoveries." In discussing contemporary science in relation to the daily lives of the world's citizens, he indicated that of all intellectual activity, science alone has flourished in the last century and has turned out the kind of universality among men which the times require, for science ceases to exist as such when it is cloaked in the garb of nationalism. In those areas of the world in which science has not merely been disturbed or arrested by war and terror, but

Two of the laboratory rooms in the Institute's new group of the William Thompson Sedgwick Laboratories of Sanitary Engineering. At the left is shown the Laboratory of Sanitary Bacteriology and Research of which Professor Murray P. Horwood, '16, has charge. Clair N. Sawyer, Associate Professor of Sanitary Chemistry, is in charge of the Laboratory of Sanitary Chemistry and Research at the right.

where terror and its official philosophy have, in a sense, corrupted its very foundations, Dr. Oppenheimer reminded his audience, even the traditional fraternity of scientists has not proved adequate protection against decay. When it becomes absolute, or tends so to become, tyranny finds it impossible to live with science. But it is not the purpose to summarize this lecture in these columns; rather, The Review hopes to have the privilege of bringing to its readers the entire stimulating address which made up the second of these memorial lectures.

The Arthur Dehon Little Memorial Lectures, established in memory of the late Arthur D. Little, '85, were inaugurated last year by Sir Edward V. Appleton, who has recently been awarded the Nobel prize in physics for his early work in the investigation of the properties of the ionosphere.

Sedgwick Laboratories Dedicated

THE William Thompson Sedgwick Laboratories of Sanitary Science were dedicated in the Department of Civil and Sanitary Engineering at the Institute on Wednesday, December 3, during exercises which emphasized the role of engineers in maintaining public health. The new laboratories of sanitary engineering, sanitary chemistry and research, and sanitary bacteriology and research are designed to meet modern educational procedures in teaching sanitary engineering and to provide a thorough knowledge of the chemical and biochemical reactions which take place in the treatment of water, sewage, and industrial wastes.

Dr. John B. Wilbur, '26, Head of the Department of Civil and Sanitary Engineering, presided at the dedication exercises, and Dr. Samuel C. Prescott, '94, formerly Dean of Science, and Professor Emeritus of Industrial Biology at the Institute, described the work of Professor Sedgwick, whose many important contributions to sanitary science and public health are memorialized in the new laboratories named for him.

Laboratory training and sanitary engineering practice in maintaining health was discussed by Arthur D. Weston, chief engineer of the Massachusetts Department of Public Health. Dr. Gordon M. Fair, '16, Dean of Engineering of the Harvard Graduate School of Engineering, spoke on sanitary engineering education, giving particular emphasis to the value of experimental methods and laboratory techniques.

Professor William E. Stanley, who has charge of the new laboratories, described the facilities of each of the new laboratories. Murray P. Horwood, '16, Professor of Sanitary Science, is in charge of the Laboratory of Sanitary Bacteriology and Research; Clair N. Sawyer, Associate Professor of Sanitary Chemistry, is in charge of the Laboratory of Sanitary Chemistry and Research; and Ariel A. Thomas, '36, Assistant Professor of Sanitary Engineering, is in charge of the Laboratory of Sanitary Engineering.

Experimental Science Lectures

AS has been customary, with the exception of certain war years, ever since the Massachusetts Institute of Technology operated under its charter from the Commonwealth of Massachusetts, a series of free popular lectures will be given this season at Huntington Hall in the main buildings of Technology.

The four lectures in this season's program are aimed to interpret science for the nonspecialist, and emphasis will be placed on the demonstration aspects of those branches of science to be discussed. The Society of Arts lectures, to be held at 4:00 P.M. on Sundays, will be given by prominent Faculty members as follows:

"New Developments in Food Technology, One Answer to Food Shortages" by William L. Campbell, '15, Professor of Food Technology. Sunday, December 21

"Nuclear Power" by Clark Goodman, '40, Associate Professor of Physics. Sunday, January 18, 1948

"Sound and Silence" by Richard H. Bolt, Associate Professor of Physics. Sunday, February 15, 1948

"Internal Combustion Engines" by Edward S. Taylor, '24, Professor of Aircraft Engines. Sunday, March 14.

Although these well-known Society of Arts lectures are free, admission is by ticket only. They may be obtained one week before each lecture by sending a stamped addressed envelope to the Society of Arts, Room 4–415, M.I.T., Cambridge 39, Mass.

James F. Norris Memorial Shelf

THE memory of James F. Norris, for many years Professor of Chemistry at M.I.T., was honored at luncheon ceremonies during the fall meeting of the American Chemical Society in New York, when a group of alumni of the Johns Hopkins University dedicated the establishment of the James F. Norris Shelf in the Johns

Hopkins University Library. In thus honoring one of their own distinguished classmates, Johns Hopkins alumni paid tribute to a man who made many friends at the Institute where he was professor of general chemistry from 1916 to 1920, and professor of organic chemistry from 1920 until his death in 1940, and who was president of the American Chemical Society in 1925 and 1926.

Each book on the Norris Shelf will have a book plate which will bear the statement, "Presented by the Chemistry Alumni, in memory of Dr. James Flack Norris, A.B. 1892, Ph.D. 1895, Past President A.C.S. 1925 and 1926." Mrs. Norris, who was present at the dedication ceremonies will add to the shelf on January 20 each year, the anniversary of the birth of Dr. Norris. Through these and other contributions, it is expected that the Norris Shelf will be kept up to date.

Dr. E. Emmet Reid, Professor Emeritus of Johns Hopkins University, prepared a suitable biographical sketch of Professor Norris' active and fruitful life which read in part as follows:

"Dr. James Flack Norris was born in Baltimore, January 20, 1871, the son of Rev. Richard Norris. His life is a tale of two cities, Baltimore and Boston. He was brought up in Baltimore and received undergraduate and graduate training at the Johns Hopkins University, A.B. 1892 and Ph.D. 1895. The remaining forty-five years of his life were spent in Boston except for brief interruptions. In the fall of 1895 he went to the Massachusetts Institute of Technology as an assistant but was soon an instructor and later an assistant professor. From 1904 to 1915 he was professor of chemistry at Simmons College, just across town from M.I.T. For one year he got away from baked beans and was professor of chemistry at Vanderbilt University. He returned to M.I.T. in 1916 as professor, later director of research. He lectured at Harvard and Clark Universities. From 1916 until his death August 3, 1940, M.I.T. was the center of his activities."

Scientific Aids to Learning

METHODS of collecting, organizing, and communicating knowledge will be studied in a center for scientific aids to learning now being established at M.I.T. under a grant of $100,000 from the Carnegie Corporation of New York. In making this announcement last month, President Compton stated that the new center is conceived as a national and international resource in its field. It will concern itself with research and experimentation on aspects of printing, documentary reproduction, visual education, sound recording, and mechanical selection systems. It will also serve as a center for training technicians, librarians, and others in allied fields in the theories and practices of scientific aids to learning. Perhaps one of its most important services will be to serve as a center of information for those who desire to learn what facilities are available in the communication of knowledge.

In a joint statement outlining the objectives of the center, John E. Burchard, '23, Director of Libraries, and Vernon D. Tate, Librarian of the Institute said:

We have recognized for a long time that we should make, through the library of the Massachusetts Institute of Technology, a contribution to world scholarship which would be comparable to those we have been making through our classrooms and laboratories. The library has for many years been exceptionally large for a technological institution and now houses many important collections whose expansion and development would provide the traditional opportunity to make such a contribution.

It has been our conviction, however, that we could make a more significant contribution by undertaking investigations extending beyond the frontiers of the library into areas in which the broad scientific and engineering facilities of the Institute and the counsel of outstanding members of its staff would be marshaled for the benefit of scholarship. The generous grant from the Carnegie Corporation now makes it possible to begin this important work.

The rapid increase in knowledge in all fields of human endeavor requires new concepts of the organization and use of information. Books can no longer be regarded as the only primary medium for the storage of knowledge, and indeed in terms of space they are no longer the most efficient. There are very good reasons, in fact, for believing that, except for the great collections of literature, books will be supplanted eventually by more efficient and convenient mediums for accumulating and disseminating knowledge. This is a problem of great concern to scholars and educators.

A wide variety of techniques, some in existence, others in early stages of development, offer promising possibilities for research in this very important field. The motion picture, well established as a medium of entertainment, can be profitably explored as a means of visual education. Microphotography is technically well advanced, but its applications lag. Television of the printed word is technically simple, but to apply it to library resources poses complex economic and intellectual problems. Rapid selection systems are already well developed for business records and are promising for bibliographical purposes, but the problem of using them to advantage in scholarship has barely been sketched.

Five fields offer particularly attractive possibilities for a program of research in the Institute's new center for scientific aids to learning. These include printing, one of the most important, which embraces all the variations of processes ranging from letter press through offset lithography and the many less pretentious forms of duplication; another is documentary reproduction which includes all methods of reproducing materials by photography, microphotography, microcard, miniature facsimile, and related techniques. Visual education is concerned with the uses of visual techniques in instruction, utilizing lantern slides, motion pictures, and other methods for textual and nontextual materials. The field of sound recording must be concerned with the full exploitation of the sense of hearing, while methods of mechanical selection, dealing with theories of coding and mechanical methods for assembling, arranging, and supplying data of all types through punched cards or other media, is still another important field for research.

Basic laboratory research alone will not provide answers for many of the problems that will inevitably arise in such a comprehensive program. The results must be tested in teaching, in the Institute's library, and through the co-operation of the great libraries of neighboring institutions, such as that of Harvard University and the Boston Public Library, which is assured through existing close relationships.

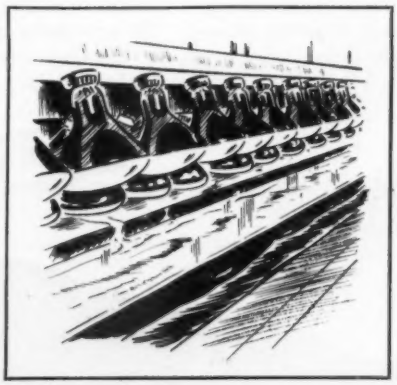
The work of the center for scientific aids to learning will be closely associated with the Institute's expanding library program. The physical plant will consist of a simple office and laboratories. Existing facilities will be utilized wherever possible and in addition to darkrooms, work areas, utilization and storage spaces for microfilm, lantern slides, motion picture films, and sound recordings will be installed in the new library. Provision for a small machine shop to be used for experimental work, maintenance and repairs, together with a special exhibit of past and current equipment, and an inclusive library largely assembled from periodical literature will be made. In its larger concept when the plant is in full operation the entire library will become the laboratory. *(Continued on page 166)*

BUSINESS IN MOTION

To our Colleagues in American Business . . .

Several years ago it became evident that the architectural profession and the building industry were being plagued and puzzled by failures in copper sheet used in gutters, flashings, and roofs, particularly on larger buildings. Since the copper had been specified and installed in accordance with then-current practice, there was a natural tendency to blame the metal. The fact that centuries-old copper in European roofs had given no trouble, and that many old copper roofing installations in this country were still good, suggested that some new factor had entered the picture.

Revere decided to discover what this factor was. First, experienced construction men were sent on a tour of inspection of both old and recent roofs, to examine gauges, tempers, sheet lengths, methods of making joints, and provisions for expansion and contraction. It quickly became apparent that failures had their source in movement of the metal due to changes in temperatures. Buckles concentrated their stresses at angular bends, and as the copper was repeatedly flexed at these points, it eventually cracked.



Comparisons with successful roofs led to conclusions that seemed reliable, but it was felt desirable to check these by experimental work that would permit the making of those measurements and confirmatory tests that are essential to accurate analysis and dependable recommendations. Full-scale replicas of actual constructions were built in the Revere Laboratory, and subjected to conditions approximating those of actual service. By means of infra-red lamps the metal was heated, and then chilled by a "rain" of cold water. Thus in ten minutes the effects of a year of exposure could be simulated. These tests were spectacular. Movement and failure could be seen easily, and recorded in motion pictures.

The observations made in these and other laboratory tests provided the background for quantitative stress analyses and made it apparent that copper roofs and copper gutters must be considered from the structural point of view rather than regarded as mere weatherproofing veneers. The columnar strength of formed sheet metal sections was demonstrated to be of particular significance in these applications. Such strength is needed for two principal purposes: to permit the inevitable movement to be fully transmitted to and taken up by expansion joints, and to overcome friction with the underlying materials. As the work proceeded, new specifications and working designs were developed, including such matters as gauges and tempers of copper for various installations, the protection of the underside of the metal from tar or other substances restricting its movement, the spacing and construction of expansion joints, seams, flashings and valleys, and how to make successful repairs when needed in present roofs. All these were proved by Laboratory experiments. The information is contained in a 96-page booklet, highly praised by architects, builders, and sheet metal contractors as the solution to the problem.

These extensive studies were undertaken by Revere not only to protect its own business in sheet copper for roofing, but out of a sense of obligation to its customers, to architects and builders, and indeed to the entire sheet copper industry. There is nothing unusual about such an attitude. You will find it everywhere. Therefore Revere suggests that no matter what you buy, nor from whom, you consult with your suppliers if you encounter any difficulties in the fabrication, use, or serviceability of their materials. In most cases you will be able to obtain immediate assistance, and if not, you should find an eager willingness to cooperate.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

☆ ☆ ☆

Executive Offices:

230 Park Avenue, New York 17, N. Y.

THE INSTITUTE GAZETTE

(*Continued from page 164*)

In documentary reproduction, the staff, Faculty, and library have already become accustomed to the use of the products of several techniques; large holdings of material on microfilm have been acquired and several reading machines are in use. The students' reader, initially distributed nearly a decade ago by the Carnegie Committee on Scientific Aids to Learning and now in use throughout the world, was designed and perfected at M.I.T.

Basic research in sound recording, applied acoustics, phonetics, and instruction through audio processes is already under way in the Institute's new Acoustics Laboratory, the Departments of Modern Languages, English and History, and others. Methods of mechanical selection are being studied in the Department of Electrical Engineering, and possible applications to the chemical literature are under way in the Department of Chemistry under sponsorship of the American Chemical Society.

Resources

BREADTH of viewpoint and interest is a primary objective of modern education in science and engineering. Obviously this objective can be attained only by instructors whose educational experience has extended beyond the narrow channels of professional scholarship. It follows then that teachers with these qualifications may be expected to encourage in their students those habits of thought and good taste which are the very substance of culture and the foundation for satisfactory living.

How fortunate the Institute is in having on its staff well-rounded men of exceptional breadth and ability was demonstrated recently when new members of the staff were introduced to their colleagues on the Faculty. One young assistant professor holds degrees from Williams College and Harvard University, as well as from M.I.T. He has practiced law and during World War II served in the Office of Scientific Research and Development. Another comes to the Institute with a background of training in social science at the College of the City of New York. He also holds a master of arts degree in economics from the University of Wisconsin, and the degree of master of public administration from Harvard University. In addition to his teaching at M.I.T., he is a candidate for the degree of doctor of philosophy at Harvard University. During the war he was administrative assistant in the National Housing Agency.

A new member of the staff in Mechanical Engineering was born in the Philippine Islands and educated at Stevens Institute of Technology where he was graduated first man in his class. After teaching experience at Stevens he joined the staff of the Radiation Laboratory at M.I.T., where at the same time he undertook graduate work in the Department of Mathematics and was awarded the degree of doctor of philosophy last year. Another new member of the same Department, a graduate of the Institute in 1941, brings to his new teaching post valuable experience gained through his activities as an officer in the Quartermaster Corps where he advanced to the rank of major, and served as director of textile research

(*Continued on page 168*)

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American Optical COMPANY
Scientific Instrument Division
Buffalo 15, New York

Manufacturers of the **SPENCER** *Scientific Instruments*

THE INSTITUTE GAZETTE

(*Continued from page 166*)

and development. Returning to the Institute, he completed his work for the master of science degree in textile technology this year.

Three new members of the staff of the Department of English and History have a rich background of education and experience. One is a graduate of Amherst College and holds the degree of doctor of philosophy from Harvard University. During the war he served as an officer in the Navy where he became instructor in aviation gunnery, later joining the historical section in the office of the Chief of Naval Operations. He has completed a historical study of naval logistics which is being prepared for publication.

Another interesting member of the staff is a professional violinist who was conductor of the M.I.T. Symphony Orchestra last year. He joins the staff as assistant professor of music to take charge of the senior humanities option, Introduction to Music, and to supervise and develop the musical interests of the students. He studied at the Hamburg Conservatory of Music and the Academy of Music at Cologne, and at one time served as concert master of the Berlin Symphony Orchestra and Director of the Hamburg University concerts. After coming to this country he was for five years a member of the faculty of Yale University, School of Music, and during the last year of the war he was music adviser to the First Service Command of the Army.

The third new member of the Department is a graduate of the liberal arts college of Johns Hopkins University. After a brief experience in business, he returned to Johns Hopkins to take a degree in mechanical engineering. His experience includes a position with the General Motors Corporation where he was concerned with the editing of technical reports. Later he was a member of the technical information staff of the Ethyl Corporation Research Laboratories in Detroit, where he gained further experience in writing. He joined the Institute as an assistant professor of English to teach courses in report writing and to assist in the preparation of technical reports for one of the Institute's laboratories.

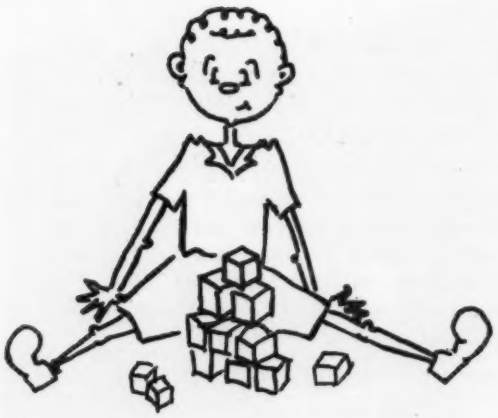
A new member of the staff in the Department of Aeronautical Engineering is a native of China, where he was born in 1909. He was graduated in 1930 from Chiao-Tung University, and from 1930 to 1936 he was an instructor in physics and chemistry at Tai-tsang and Hwai-an schools in Kiangsu. During this period he also served as a consulting engineer in the electrical field. He was awarded fellowships for study in the United States between 1936 and 1941, and received the degree of master of science in aeronautical engineering from M.I.T. in 1938, and his doctor's degree in the same field in 1941. During the following year he was a technical assistant in the aviation division of China Defense Supplies, Inc. in Washington. In the fall of 1942 he came to the Institute to work in the Instrumentation Laboratory on fire control and gunsight projects. He has contributed many important papers in his field.

(*Continued on page 170*)

For the

YOUNG MEN

of Industry . . .

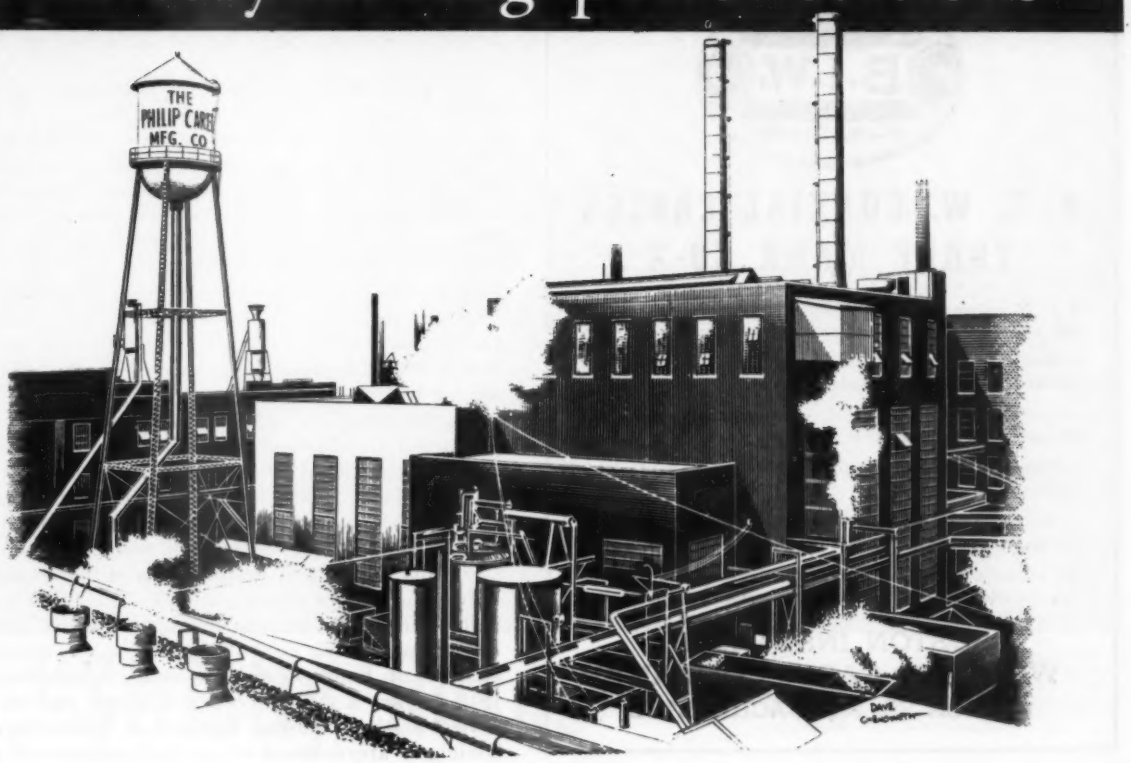


Nearly every graduating senior buys and cherishes a copy of TECHNIQUE — the M.I.T. yearbook. Can you think of a better way to bring your product to the attention of the young men of today who will make the executive decisions of tomorrow? We would appreciate your inquiries regarding advertising in . . .

THE 1948 TECHNIQUE

ROOM 309
WALKER MEMORIAL
M.I.T. CAMBRIDGE

History-making power stations



No. 5 – *Lockland, Ohio, Plant*

THE PHILIP CAREY MANUFACTURING COMPANY

In May of 1931, at the time the Lockland power plant went into operation, an article in the magazine POWER stated:

> "Over two years ago engineers were astounded by the announcement that the new power plant of the Philip Carey Company at Lockland, Ohio, would employ a steam pressure of 1840 pounds per square inch . . . Not only is this the highest pressure yet employed commercially in this country, but the plant is the largest in any country to employ such a pressure."

The Philip Carey Company didn't decide to take this pioneering step in order to set a record. Their particular requirements of steam for both power generation and process made it the economical thing to do. Nevertheless, it took courage to make a large capital investment in equipment to operate under conditions that were then beyond the limits of commercial practice. We are proud of the fact that Combustion Engineering was selected to design and build the two steam generating units for the Lockland plant – the largest roofing plant in the country and producer of a wide variety of insulating, waterproofing and other building materials.

The association of C-E equipment with Lockland and many other power stations that have made history in the field of steam generation speaks for itself. The experience, special skills and advanced engineering which have brought about this association are available to you, whether your steam requirements be large or small.

These three factors are the unwritten plus-values in every C-E contract –

Knowledge – *to solve today's, and tomorrow's, steam generating problems.*

Experience – *to interpret, from a world-wide background in every important industry, the specific needs of each installation.*

Facilities – *to manufacture complete steam generating units for every capacity from 1000 pounds of steam per hour up to the largest.* B-150

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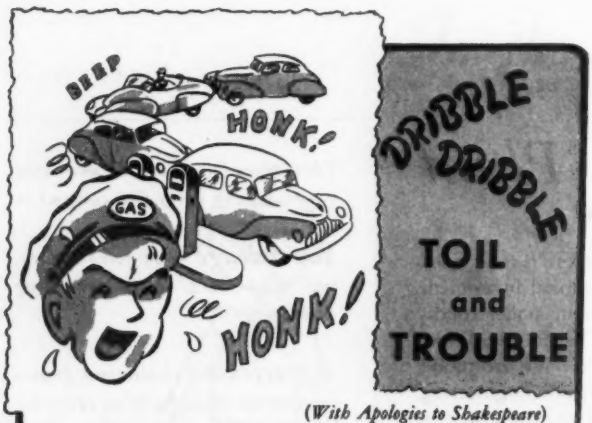

(With Apologies to Shakespeare)

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Installed on any standard automobile tank, the VENTALARM Fill Signal permits fueling at full pumping speeds *without blow-back;* provides instant, positive warning when the tank is properly filled.

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SCULLY SIGNAL COMPANY
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VENTALARM
GAS TANK FILL SIGNAL

THE INSTITUTE GAZETTE

(Continued from page 168)

New members of the staff of the Department of Mathematics include a graduate of the University of Illinois who was awarded the degree of doctor of philosophy in 1939. He began his teaching experience as an instructor for a year in the University of Alabama from which he went as a fellow to the Institute for Advanced Study at Princeton University. During the war he was engaged for a time in research and later was appointed an assistant professor at the University of Michigan. Later he was a visiting assistant professor at Yale University, and further enriched his teaching experience as an assistant at the Institute for Advanced Study before joining the Institute's Faculty.

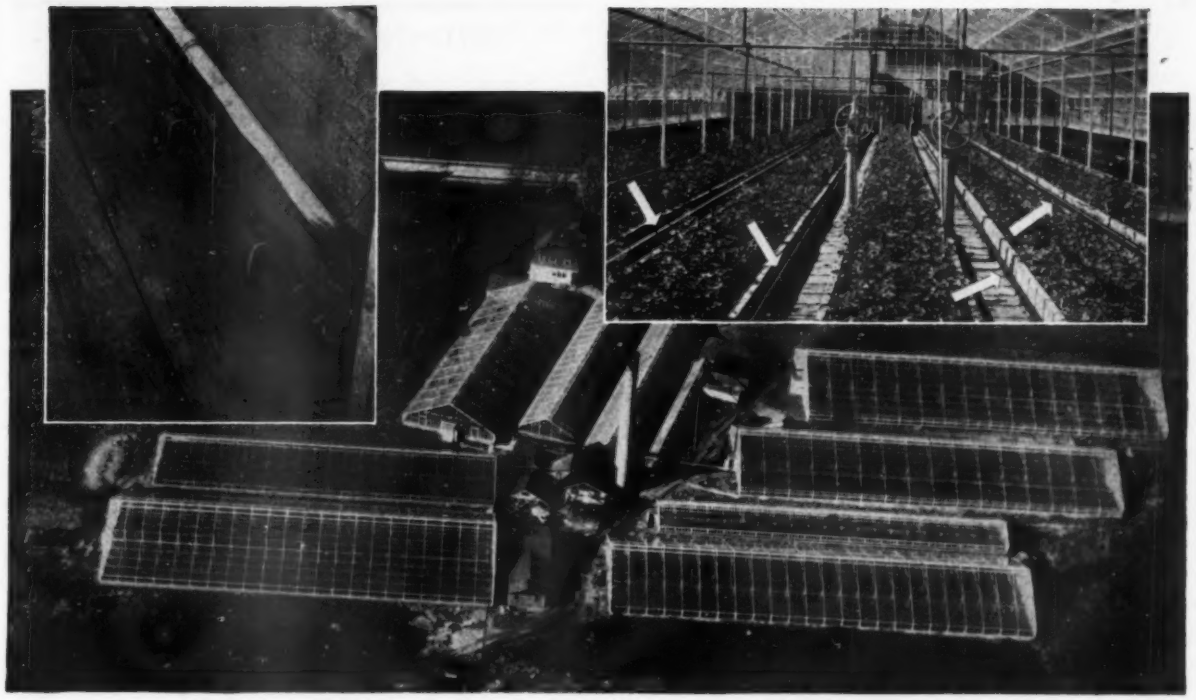
Another member of the Department is a native of China and a graduate of National Tsing Hua University, where he completed the work for the degree of bachelor of science in 1937. He went to Canada for advanced work and was awarded the degree of master of arts from the University of Toronto in 1941, after which he entered the California Institute of Technology and was awarded the degree of doctor of philosophy in 1944. He then returned to his homeland to become an assistant at the Tsing Hua University, serving until 1939 when he was appointed a Sino-British Funds Fellow. Returning to this country in 1943, he was a member of the research staff on a war project at the California Institute of Technology, later holding an appointment as assistant professor of applied mathematics at Brown University.

A new member of the staff of the Department of Meteorology is a graduate of New York State Teachers College who holds the degree of master of science from M.I.T. and his doctorate in meteorology from the University of Chicago. He brings to the Institute a background of experience which includes work in the United States Weather Bureau and the University of Chicago, where he was an assistant professor from 1943 to 1947. He has also served as editor of the *Journal of Meteorology*.

The Department of Civil and Sanitary Engineering has two new members of the Faculty whose background of experience and education enrich the resources of that Department. One was graduated in Civil Engineering from the Institute, carried on graduate work in sanitary engineering at the University of Illinois and later was associated for five years with the Sanitary Engineering Division of the State of Illinois. He then joined the Sanitary Corps of the United States Army as an officer and is now in charge of the engineering division of the new Sedgwick Laboratories of Sanitary Science. Another member of the Department who did his undergraduate and graduate work at M.I.T., returns after broad experience in industry.

The Department of Physics has a new member of the staff, who was educated at the College of the City of New York, holds the degree of doctor of philosophy from Columbia University, and was an instructor in both institutions. From 1942 to 1944 he was a staff physicist in the metallurgical laboratory of the University of Chicago. Later he served on the staff of the University of California on the Los Alamos atomic bomb project.

(Continued on page 172)



Chevalley Greenhouses at Bayport, Long Island, as seen from the air. Insert at left shows how a separate Webster Heavy Duty Trap, protected by a Webster Strainer, serves to drain each separate long pipe line. Insert at right shows the pipe lines thus drained running alongside the growing troughs.

"Strictly Roses"

Chevalley Greenhouses at Bayport, Long Island, grow nothing but roses. At any given moment this successful business has a substantial investment which could be greatly impaired by sudden temperature changes.

Chevalley fully appreciates the importance of reliable, flexible and fool-proof heating. They provide this heating through steam with a separate steam line along each side of each trough, as shown above at right.

Before selecting Webster Steam Heating Equipment, Chevalley made a thorough study of the various types of traps available, visiting and examining many greenhouse installations. By ordinary engineering standards figuring the amount of surface in each coil, only a small thermostatic trap would be required. Chevalley determined that the preferred solution is a separate Webster Series 26 Float and Thermostatic Drip Trap on the discharge of each long pipe coil.

When the sun is on the glass there is no heat in this piping. But let there be a clouding over of the sun and a drop in temperature and Chevalley requires instant heat the full length of the pipe coils.

Regardless of how suddenly steam is turned on to any pipe coil, a Webster Series 26 Trap provides immediate full drainage of condensation, big overload capacity when cold, and elimination of any possibility of damage through water hammer. Satisfactory operation is assured regardless of whether the control of steam supply is manual or automatic.

Webster worked with Chevalley Greenhouses in solving this problem and appreciates their courtesy in permitting us to tell the story in our advertising. Webster men have helped to solve greenhouse heating problems for more than thirty years. If you have a greenhouse heating problem write us about it. We will pass it on to the Webster Representative nearest you. He will be glad to work on it with you.

WARREN WEBSTER & CO., Camden, N.J.
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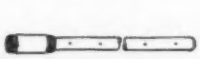
Webster
HEATING SYSTEMS

Some Items of Webster Equipment For Greenhouse Heating

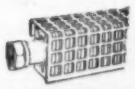


Webster Manifold Coil Orifice Fitting balances steam distribution in pipe coil installations, resulting in partial heating throughout entire length.

Webster EH-10 Moderator Control Cabinet and Outdoor Thermostat provides automatic heat variation.

Webster Float and Thermostatic Drip Traps provide immediate full drainage of condensation, big overload capacity when cold.

Webster Thermostatic Radiator Trap—the world's best known radiator trap.



Webster Type WI Radiation. One line does the work of an entire manifold coil.

Get to know the modern Rogers Peet!

First impressions!

Someone may be sizing you up right now. What will be his or her impression?

The *right* clothes are an outward and visible sign of your own estimate of yourself.

Rogers Peet Clothes give a quiet, well-bred assurance. They are an unmistakable asset — for the man at the top, as well as for the younger man on his way up.

Styles for young men, and men who never grow old.

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Makers of Fine Clothes

In New York:
Fifth Avenue at 41st Street
Thirteenth St. at Broadway
Warren Street at Broadway
And in Boston:
Tremont St. at Bromfield St.

THE INSTITUTE GAZETTE

(*Continued from page 170*)

The Department of Metallurgy has three new members of the staff with wide experience in teaching and research. One is a graduate of Rensselaer Polytechnic Institute and holds the degree of doctor of science from M.I.T. He is a former chief metallurgist in the magnesium foundry of the United States Radiator Corporation and was later a metallurgist in the General Electric Company.

Another who holds undergraduate and graduate degrees from the Institute served as secretary, interpreter, and editor of *Transactions of the Singer-Polignac Astrophysics Colloquium* in Paris in 1939. From 1940 to 1942 he was assistant in charge of research in the Diamond Drilling Department of the New Consolidated Gold Fields in Johannesburg, South Africa. He also served as a consulting engineer on problems of abrasives in South Africa and later formed a company for making tungsten powder from African ores and manufacturing tungsten carbide for use in mining. He served during the war as consultant to South African industry on powder metallurgy.

The third new member of the staff is a graduate of the University of Toronto where he served as instructor in ore dressing from 1937 to 1941 when he joined the Department of Mines and Resources of Canada until 1947 when he came to the Institute.

The educational background and experience of four new members of the staff of the Department of Business and Engineering Administration still further emphasize the breadth of the Institute's staff. A new assistant professor of accounting is a graduate of the University of Oregon and the Harvard Business School, who also served with the government during the war. He has had experience as a practicing certified public accountant and has taught accounting in the University of Oregon. A new assistant professor of business management, a graduate of Williams College, who holds a master's degree from the Institute, had wide experience in military service before returning to accept a post in the Department.

The third member of the staff, an assistant professor of marketing, is a graduate of Pennsylvania State College where he also instructed in economics. He became an assistant in economics and business organization in Ohio State University, and subsequently returned to Pennsylvania State College as an assistant professor of marketing and economics. During the war he had experience on the War Production Board and later served in the Navy.

A visiting professor in the Department is a distinguished representative of industry who was graduated from Stanford University and came to the Institute on leave of absence from the Standard Oil Company of California, to which he is organization counsel. During the war he was Director of Organization of the Petroleum Administration for War, later becoming organizational adviser to General Clay, Commanding General of the United States Zone in Germany.

The summary of experience recorded here does not, of course, include the diverse professional careers of seasoned Faculty members. Nevertheless, it does indicate the varied backgrounds which may be — and are — drawn upon in the training of M.I.T. scientists and engineers.

(*Concluded on page 174*)

I wish every college man could read this letter.
HCC

You ask how I made the college-to-career jump--well, here's my story.

Early in 1943, Hitler & Company put an end to my architectural studies at Northwestern and I was soon off to the North Atlantic for long months of patrol. Next came shore duty in and around New England. While there I married a girl who, when I went back to sea, worked in the big, white home office building of the New England Mutual Life Insurance Company across the street from Coast Guard headquarters in Boston.

During my service years I had decided that I didn't want to be an architect after all, so when I became a civilian again, we moved to Grand Rapids, where my wife used to live. I got a job in radio. Then I tried retail merchandising, but I wasn't satisfied with either.

One day a New England Mutual agent called on me. During our talks I became a policyholder, but more than that, I saw in this agent's career the very things I most wanted: independence, no ceiling on earning possibilities, a chance to use some initiative, and no waiting around for somebody to retire before getting a promotion. So I took the company's aptitude test, and soon I was a New England Mutual agent.

I've been back to that big home office building in Boston for a training course--and now, after my first six months on my own, I am more certain each day that my choice of a lifetime career was right for me. I get a lot of satisfaction, too, out of knowing that I am responsible for the improved financial well-being of certain people who now own over a hundred thousand dollars of life insurance that they did not own when I entered the business.

Sincerely,

Gordon C. Lindemann

If you'd like more facts and figures about a well-paid career with New England Mutual, just write to Mr. H. C. Chaney, Director of Agencies, New England Mutual Life Insurance Company, 501 Boylston Street, Boston 17, Massachusetts.

Here are some of the M. I. T. men now with New England Mutual:

Raymond P. Miller, '18, Salem
Blaylock Atherton, '24, Nashua
Arthur C. Kenison, '19, Boston
Leland S. Person, '34, Rutland

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Electric Heat Treating Furnaces
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Hevi Duty Precision Electric Heat Treating Furnaces are built in a large variety of types and sizes — for many heat treating operations — with temperature ranges to 2500° F. (1371° C.). They are standard production equipment in many national industrial plants.

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HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI DUTY ELECTRIC EXCLUSIVELY
MILWAUKEE 1, WISCONSIN

THE INSTITUTE GAZETTE

(*Concluded from page 172*)

Hartley Medal to Dr. Compton

THE Marcellus Hartley Medal for "eminence in the application of science to public welfare" was awarded to President Karl T. Compton by the National Academy of Sciences on November 18.

In making the award, the Academy citation stated that President Compton had been chosen 1947 recipient "because of his notable contributions of an original character to the science of physics, his long and valuable career in the field of education and university administration, and in recognition of his eminent service in the wartime research effort of the nation, and in the reinforcing of collaboration and understanding between civilian scientists and military men."

During World War II, Dr. Compton served as director of Field Service in the Office of Scientific Research and Development.

THE TREND OF AFFAIRS

(*Continued from page 148*)

their own common labor as well as their own skilled and semiskilled mechanical work. The week-end athlete has long been an American institution; the week-end laborer is becoming equally common. Therefore, if one of these suburbanites developed amnesia, and his bodily stigmata were studied to aid in his identification, he might present the baffling combination of marks characteristic of the sedentary desk worker and pencil user, the painter, the carpenter, the landscape gardener, the bricklayer, and the sweeper.

Aerial Perspective

FIRST American-made automatic focusing photogrammetric instrument for rectifying prints in the making of photographic mosaic maps was delivered early in December to the United States Army, Corps of Engineers. The new instrument will be of paramount significance not only in aerial reconnaissance work but also in making studies of flood control and soil erosion.

The instrument resembles an ordinary photographic enlarger in general appearance but carries out automatically many more functions. It simultaneously enlarges and prints, as do photographic enlargers. In addition, it automatically reduces aerial photographs to a common scale so that all prints may be easily fitted together in building up the mosaic. Because planes equipped with the most modern stabilizers can maintain their level constant to within only one quarter of a degree, means for rectifying the prints, that is, of eliminating the keystone effect encountered in photographing the surface of the earth when the camera lens is not exactly perpendicular to the earth's surface, becomes necessary in the production of the individual prints used to make precise aerial photographic maps. Tilt of as much as 20 degrees can be rectified in the new machine, and this is accomplished auto-

(*Concluded on page 176*)

THE GLUE THAT BINDS NOW DRIES IN *Seconds!*

Remember back when gluing wood was a sticky job and hours were required for the glue to "set"?

Modern electrical production methods have changed that job, too. The "heatless heat" of high-frequency radio waves now dries the glue and bonds the wood in seconds. "Edge-gluing" on a conveyor line basis turns waste wood pieces into valuable furniture.

As shown here, for example, boards 48″ long by 38″ wide by 1″ thick can be made up of 15 or 20 scrap pieces—and glued in 30 seconds, ready for conversion into fine cabinets. Time and space for storage in clamps is done away with—variations in clamping pressure and drying conditions are eliminated—up to 50 per cent savings in glue are effected—and three semi-skilled men can produce what six produced before.

Westinghouse Radio-Frequency Heating offers savings in other fields, too. Plywood now can be made to almost unlimited thicknesses, timber arches are easily fabricated, and cabinet or other wood-joining problems are handled with ease.

A complete line of Westinghouse Radio-Frequency Equipment for both dielectric and induction heating is now available. For more information about how and where radio-frequency heating can be applied in your plant, write on your letterhead to Westinghouse Electric Corp., Dept. T, P. O. Box 868, Pittsburgh 30, Penna. J-85004

INVESTIGATE!

Radio-Frequency Heating is just one of many new or improved electrical techniques for producing faster, cheaper, better. Westinghouse engineers can quickly give you salient facts on others applicable to your industry, including the following:

- Electric Furnace Brazing
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Write or phone your nearest Westinghouse office for details.

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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MORE PRODUCTIVE POWER FOR INDUSTRY

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Samson Cordage Works

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Manufacturers of braided cords of all kinds, including sash cord, clothes line, trolley cord, signal cord, shade cord, Venetian blind cord, awning line, etc., also polished cotton twines and specialties.

SPOT CORD

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Our extra quality sash cord, distinguished at a glance by our trade-mark, the colored spots. Especially well known as the most durable material for hanging windows, for which use it has been specified by architects for more than half a century.

WHERE SPECIALTY IS STANDARD

...In the design of all TIREX portable cords there is but one standard jacket—a special Selenium-Neoprene compound that's cured in lead.

No other cord jacket provides more lasting protection against acids, oil, sunlight, flame and abrasion.

In the service of electrically-powered portable apparatus, TIREX cords with Selenium-Neoprene Armor are your assurance of dependable, trouble-free performance.

SIMPLEX WIRE & CABLE CO.

79 Sidney St., Cambridge 39, Mass.

THE TREND OF AFFAIRS

(Concluded from page 174)

matically without the calculations and manual adjustments previously required. The rectifier is small enough to be mounted in a trailer for field work, and uses fluorescent illumination. Individual prints can be produced every five minutes.

Although projectors capable of effecting rectification are by no means new, the feature of the new Bausch and Lomb rectifier is its ability to correct automatically for tilt of the plane. In the mathematical calculations and mechanical and optical design underlying this instrument, John V. Sharp, '36, made significant contributions.

Reducing Fatigue

REPETITIVE bending acts on the crystalline structure of ferrous metallic substances in such a way as to cause fatigue. Under continued use, the ultimate breaking point may be but a small fraction of the initial breaking point; what is worse, adequate safety factors provided in the original design gradually are diminished, sometimes with disastrous results.

Recent research has disclosed that the fatigue of iron may be greatly minimized by alloying it with certain other metals. Metals which have been found useful in improving the fatigue strength of iron, in order of their effectiveness, are titanium, molybdenum, silicon, manganese, nickel, cobalt, and chromium. Such research as has led to this discovery is expected to suggest means for treating metals so that the fatigue life may be appreciably increased. At the same time, it aids in devising compositions of steels for construction purposes.

Generator for Fundamental Studies

AN electrostatic generator rated at 3,500,000 electron volts is one of several electronuclear machines planned for installation at the Brookhaven National Laboratory at Upton, Long Island, N. Y., during the coming year. The Brookhaven Laboratory is being built and administered as a regional center for the Northeast by Associated Universities, Inc., under the auspices of the United States Atomic Energy Commission. Director of the Brookhaven Laboratory is Professor Philip M. Morse, on leave of absence from the Department of Physics, M.I.T., and an editorial associate of The Review until his resignation last fall because of the pressure of his new duties.

According to M. Stanley Livingston, Associate Professor of Physics, also on leave of absence from M.I.T., the 3,500,000 electron volt machine being built by the General Electric Company first will be used for studies to determine, in part, the designs of other large machines and associated equipment for the Laboratory. Ultimately, the accelerator will serve as a source of high-energy particles to be directed in a beam of target elements for a variety of fundamental studies of the atomic nucleus. In some experiments, for example, the particles will be employed to study chipping or splitting atomic nuclei into fragments, such as radioactive isotopes now widely applied in research.

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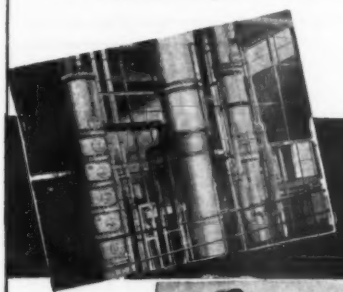

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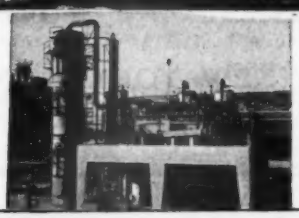

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AERIAL DIMENSION

(*Continued from page 157*)

or is likely to enter, into the symbolism and themes of aerially minded people, but a few examples may perhaps illustrate the variety.

The airplane is the symbol of, and a challenge to, an outward projection of the human personality. The urge to travel, to see foreign lands and peoples, is intensified by aviation at the same time it makes easier such fulfillment. This outward psyche is sometimes regarded as a mode of escape; possibly it is. "You feel," wrote Anne Morrow Lindbergh in *Listen! the Wind*, "no longer rooted to the earth." [12] This Daedalus-Phaëthon mythology, now a technological reality, seems nevertheless not to have escaped the Greek fate. The escaping pair of wings is still earth-bound.

Particularly in the past half century, we have seen family life in the large mansions give way to an abbreviated existence in ever smaller apartments in cities of expanding dimensions. Today the home, as a center of parental influence and filial reverence, has been accompanied by, and no doubt has been the result of, ever swifter means of transportation. After World War I, the astronomical rise in the popular use of the automobile loosened family ties by enabling the younger generation to travel away from home with increasing ease and frequency. The trailer, combining lodging with mobility, caters to the spirit of travel but again at the expense of instilling a sense of local pride and tradition. Now the

(*Concluded on page 180*)

[12] New York: Harcourt, Brace and Company, 1938. $2.50.

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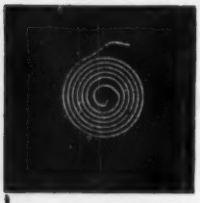

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AERIAL DIMENSION

(*Concluded from page 178*)

airplane, new instrument of space conquest, becomes a domicile for the human being. Thus, in his *Flight to Arras*,[13] Saint Exupéry echoes this feeling: "All that tangle of tube and wiring has become a circulating network. I am an organism integrated into the plane. . . . The plane is my wet-nurse. . . . Suckled by the plane, I feel a sort of filial affection for it."

A note of sadness and tragedy often enters into the human spirit in flight; the sadness and tragedy of war. The bomb bursts at Los Alamos, Hiroshima, Nagasaki, and Bikini have added unhappy overtones to this motif.

Some writers find hope in a gradual assimilation of the airplane as a machine. John Masefield, in a letter describing his first flight, wrote: "I was glad to have done it — though I felt that it belongs to this generation, and not to mine." There is much evidence, both from wartime pilots and peacetime airmen, that an air-conditioned generation is coming into being. Thus, Saint Exupéry, perhaps the most articulate of them, put it this way: "Contrary to the vulgar notion, it is thanks to the metal, and by virtue of it, that the pilot rediscovers nature." He added: "The machine, which at first blush seems a means of isolating man from the great problems of nature, eventually plunges him more deeply into them." Yet Saint Exupéry confessed that the assimilation of the machine into the emotional and intellectual life of modern man will take time. "We shall have to age somewhat before we are able to write the folk songs of a new epoch."

Meantime, there is for our guidance that curse pronounced by Selden Rodman's Inventor in his invocation to the Earth-Mother, a curse upon all who will use wings for "any ambition higher than bold design and art to freely cruise."

[13] New York: Reynal and Hitchcock, 1942. $2.75.

FACULTY IN RELAXATION

(*Continued from page 158*)

and a member of the Housing Bureau staff in fashioning necklaces, earrings, brooches, and similar jewelry from hammered silver. A professor of mechanical engineering showed a stamp collection, and a professor of economics exhibited several cases of butterflies suitably tagged with Latin names.

Perhaps one of the most unexpected exhibits was that showing the materials used and the method of constructing fishing flies. Each step in the making of flies was described in considerable detail in such a way as might,

(*Concluded on page 182*)

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FACULTY IN RELAXATION

(*Concluded from page 180*)

at other periods of the year, tend to encourage absenteeism from the classroom.

It should not be concluded that the two display cases and 10 panels shown in the photographs on page 158 represent the full range of general and cultural interests and inclinations of the Institute's educators. Last spring Faculty members had the opportunity to display their creative talents in the field of monochrome and color photography, and at least one additional exhibit is planned to include displays of those extracurricular interests which are not so easily classified as photography or art. The art exhibit, therefore, is to be regarded as but one of a series of events planned by the Faculty Club, to provide opportunity for the Institute staff to display the results of its creative abilities. Certainly the handiwork of the participants in the photographic and art displays, which have already been held, provide ample evidence that the Faculty at M.I.T. can make its mark in fields far removed from that of technical specialization. What is more — it does.

STUDENTS AT PLAY

(*Concluded from page 159*)

Shown on page 159 are a few illustrations of highlights of the student athletic week end. Top left shows an exciting moment in the hockey game at the goal net of Boston University, and (*right*) students gathered for the event. At the bottom of the page are shown M.I.T. and Brown swimmers ready for the plunge. Close examination of the novelty event will indicate that the femininity of the Fencing Team is in dress only.

Whether or not an event of this kind will become an annual affair has not yet been determined. Certainly such activities are thoroughly in accord with, if only a small part of, the general M.I.T. objective to foster broad cultural education in addition to the high caliber of technical training for which the Institute has been favorably known for more than eight decades.

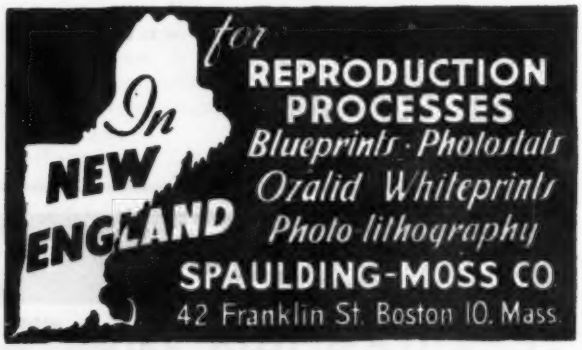

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TABLE OF CONTENTS

	Page
ALPHABETICAL LIVING SECTION — Class — Course — Degrees — Position — Firm — Address	1
ALPHABETICAL DECEASED SECTION	277
WAR RECORD SECTION — Rank — Branch of Service — Period of Service — Decorations	301
CLASS LISTS — Living Alumni, Arranged by Classes; Deceased Alumni, Arranged by Classes	351
GEOGRAPHICAL SECTION — Location — Name — Class	453
MEMBERS OF CORPORATION SINCE 1865	549
MEMBERS OF STAFF SINCE 1865	552

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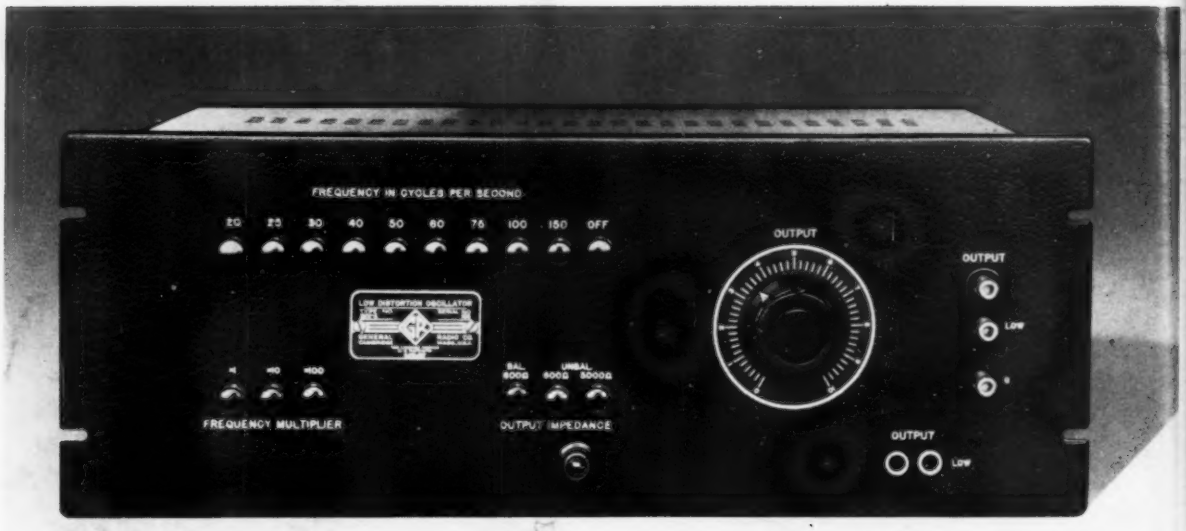

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